State of Connecticut

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Forty-seventh Annual Report

OF

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

Being the annual report for the year ended October 31

1923

PRINTED IN COMPLIANCE WITH STATUTE

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APPROVED BY
THE BOARD OF CONTROL

PRESS OF
THE WILSON H. LEE COMPANY
NEW HAVEN, CONN.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

OFFICERS AND STAFF

October, 1923.

BOARD OF CONTROL.

His Excellency, Charles A. Templeton, *ex-officio, President.*

James H. Webb, *Vice-President* .... Hamden
George A. Hopson, *Secretary* .... Mount Carmel
W. L. Slate, Jr., *Director and Treasurer* .... New Haven
Joseph W. Alsop .... Avon
Charles R. Treat .... Orange
Elijah Rogers .... Southington
Edward C. Schneider .... Middletown

STAFF.

E. H. Jenkins, Ph.D., *Director Emeritus.*

Administration.	W. L. Slate, Jr., B.Sc., *Director and Treasurer.* Miss L. M. Brautlecht, *Bookkeeper and Librarian.* Miss J. V. Berger, *Stenographer and Bookkeeper.* Miss Mary Bradley, *Secretary.* William Veitch, *In charge of Buildings and Grounds.*
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Forestry.	Walter O. Filley, *Forester in Charge.* A. E. Moss, M.F., *Assistant Forester.* H. W. Hicock, M.F., *Assistant Forester.* Miss Pauline A. Merchant, *Stenographer.*
Plant Breeding.	Donald F. Jones, S.D., *Geneticist in Charge.* P. C. Mangelsdorf, M.S., *Assistant.*
Soil Research.	M. F. Morgan, M.S., *Investigator.*
Tobacco Sub-station at Windsor	C. M. Slagg, M.S., *in Charge.*

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ERRATA.

Page 55. *Delete* 3d line from bottom:

21336 Armour's Corn Grower, 2-8-4 .... 2.73

Page 64. Table XVI. Sample No. 21336, Armour's Corn Grower. The "Grade" should read 2-8-2 instead of 2-8-4. This brand substantially meets its guaranty and should be deleted from the Table of Deficient Brands, p. 55.

Report of the Board of Control

OF

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

To His Excellency, Charles A. Templeton, Governor of Connecticut:

In accordance with Statute, the Board of Control of The Connecticut Agricultural Experiment Station herewith submits its annual report for the year ending October 31, 1923. The financial reports, however, cover the State fiscal year ending June 30, 1923.

The work of the Station for the year is discussed in detail in the Report of the Director (Bulletin 254) and the other reports and bulletins which are herewith submitted.

By far the most important event of the year has been the resignation of Dr. Jenkins. The following resolution was adopted by the Board and made a part of the permanent record:

"With great reluctance and sincere regret the Board accepts the resignation of Edward H. Jenkins, Ph.D., from the office of Director.

For nearly half a century Dr. Jenkins has been identified with the work of the Station, and has contributed invaluable services which have resulted in the position of distinction and esteem to which it has now attained.

Graduated from Yale College with the Class of 1872, Dr. Jenkins immediately began post-graduate studies under Professor Johnson, and after continuing his studies abroad received the degree of Ph.D. from Yale University in 1879.

Upon the establishment of the Station in 1877, with Professor Johnson as its first director, Dr. Jenkins was retained by him as his chief assistant, and in 1883 was appointed to the position of vice-director. In this latter position he soon became responsible for the work of the Station, as Professor's Johnson duties at the University, and later the infirmity of years, prevented him from devoting his entire activities to the work. Upon the retirement of Professor Johnson in 1900, Dr. Jenkins was appointed Director, and in 1902 was made Treasurer of the Station and of the Lockwood Fund.

The confidence and esteem which is now extended to the Station by the authorities and people of the State is in a very large degree due to the eminent personal qualities of the retiring director and to his wise and prudent administration of its affairs. It is no exaggeration to say that this institution stands to-day as a noble monument to the life work of Dr. Jenkins, to the upbuilding of which he has devoted talents of the highest order and the most faithful and distinguished service. He has deservedly won the grateful regard of the people he has served and the affection and esteem of all who have been associated with him as members of this Board or served with him upon the staff of the Station.

The Board was unable to persuade Dr. Jenkins to longer carry the duties of Director, and with great reluctance and in compliance with his most urgent solicitation has accepted his resignation and appointed him Director Emeritus. It is the earnest hope of his associates that he may be long spared to exercise a parental oversight over the affairs of the Station and to enjoy the rest and freedom he so richly deserves."

Respectfully submitted,

GEORGE A. HOPSON,
Secretary.

Report of the Treasurer

July 1, 1922—June 30, 1923

E. H. Jenkins, in account with The Connecticut Agricultural Experiment Station for the fiscal year ended June 30, 1923.

Receipts.

Balance on hand, July 1, 1922:			
Analysis Fees		$6,224.70	
Miscellaneous Receipts		703.61	
			$6,928.31
State Appropriation (General)		$41,000.00	
" " (General) (Additions)		1,012.29	
" " (Food and Drug)		7,500.00	
" " (Insect Pest)		12,500.00	
" " (Insect Pest) (Additions)		525.34	
United States Appropriation (Hatch)		7,500.00	
" " " (Adams)		7,500.00	
Fertilizer Analysis Fees		12,000.00	
Lockwood Trust Income (including sales of Mount Carmel Farm Produce)		8,300.00	
		$97,837.63	
Miscellaneous Receipts:			
Connecticut State Department of Health (rent)	$200.00		
Sales of gasoline	312.37		
Sales of automobile oil	5.64		
Mileage for use of automobiles	66.16		
Miscellaneous	25.38		
Interest on Bank Deposits	212.74		
		822.29	
			$98,659.92
			$105,588.23
Less Miscellaneous Receipts Deposited with State Treasurer			1,299.82
			$104,288.41

DISBURSEMENTS.

Salaries	$52,226.37	
Labor	10,171.20	
Publications	378.25	
Postage	207.56	
Stationery	818.13	
Telephone and telegraph	241.84	
Freight and express	183.21	
Gas, electricity, etc	1,721.45	
Coal	2,311.20	
Water	96.70	
Chemicals	1,283.03	
Laboratory supplies	1,200.47	
Seeds, plants, etc	136.31	
Agricultural and Horticultural supplies	103.35	
Food samples	56.83	
Ice	66.95	
Photographic supplies	151.83	
Automobile oil	47.88	
Miscellaneous supplies	582.89	
Fertilizers	760.10	
Feeding stuffs	90.49	
Library (books and periodicals)	891.82	
Library (binding)	336.10	
Tools, machinery and appliances (new)	1,004.38	
Tools, machinery and appliances (repairs)	86.41	
Automobiles (new)	1,369.75	
Automobiles (repairs)	548.62	
Furniture and fixtures (new)	2,947.08	
Furniture and fixtures (repairs)	78.48	
Scientific apparatus (new)	1,379.23	
Scientific apparatus (repairs)	25.03	
Traveling by the Board	334.81	
Traveling by the staff	1,271.60	
Gasoline for automobiles	686.08	
Traveling in connection with Adams Fund investigations	26.49	
Insurance (fire, burglary and automobile)	763.25	
Insect Pest Appropriation to State Entomologist	13,025.34	
Contingent	431.25	
Buildings and land (new)	80.02	
Buildings and land (betterments)	3,183.01	
Buildings and land (repairs)	2,757.54	
Total disbursements		$104,062.33
Balance on hand, June 30, 1923 (Miscellaneous receipts)		226.08
		$104,288.41

NEW HAVEN, CONN., Oct. 18, 1923

This is to certify that we have audited the accounts of E. H. Jenkins, Treasurer of The Conn. Agr. Experiment Station for the fiscal year ending June 30th, 1923, and have found them correct.

WILLIAM P. BAILEY,
LEWIS W. PHELPS,

REPORT OF

E. H. JENKINS, Director

IN ACCOUNT WITH

Mosquito Elimination Appropriation

For the year ended June 30, 1923

RECEIPTS.

Balance on hand, July 1, 1922 (Petty Cash Fund)...	$500.00	
From State Comptroller, for vouchers sent by E. H. Jenkins, Director	7,732.71	
		$8,232.71

EXPENDITURES.

Salaries	$2,400.00	
Labor	4,115.99	
Stationery	60.17	
Telephone and telegraph	1.40	
Team and horse hire and carting	107.50	
Miscellaneous Supplies	77.75	
Oil for mosquitoes	164.00	
Automobile supplies	3.85	
Automobile oil	8.40	
Automobile repairs	167.22	
Tools, machinery and appliances (new purchases)	51.68	
Tools, machinery and appliances (repairs)	46.00	
Tile, lumber and cement	19.14	
Automobile insurance	16.46	
Travel	331.68	
Travel (gasoline for automobiles)	161.47	
Total		$7,732.71
Balance on hand, June 30, 1923 (Petty Cash Fund)		500.00
		$8,232.71

Of the total amount expended in the year as above ($7,732.71), there was spent for

Supervision		$3,314.23
*Maintenance:		
Madison	$382.25	
Guilford	502.25	
Branford	752.50	
East Haven	38.00	
New Haven	412.05	
West Haven	118.00	
Fairfield	1,848.58	
Groton	40.00	
Stamford	276.85	
Orange	48.00	
		4,418.48
		$7,732.71

* Of the expense of maintenance in the towns, three-quarters is to be paid by the towns, as follows: Madison, $286.69; Guilford, $376.68; Branford $564.38; East Haven, $28.50; New Haven, $309.04; West Haven, $88.50; Fairfield, $1,386.43; Groton, $30.00; Stamford, $207.64; Orange, $36.00. Total, $3,313.86.

BULLETIN 250 NOVEMBER, 1923

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

Fertilizer Report for 1923

E. M. BAILEY, *Chemist in Charge of the Analytical Laboratory.*

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The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit

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November, 1923.

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AGRICULTURAL COLLEGE AND RES... No. 25 SEP 1925 ... CAWNPORE

Report on Commercial Fertilizers, 1923.

E. M. Bailey, *Chemist in Charge, Analytical Laboratory.*

PROVISIONS OF THE FERTILIZER LAW.

The provisions of the fertilizer law as it affects dealers in commercial fertilizers in this State have been explained in previous bulletins of this Station and the text of the law may be found in Chapter 204 of the Public Acts of 1919. Certain points of interest and importance to both buyers and sellers of fertilizers may, however, be briefly restated.

Significance of the Term "Commercial Fertilizers".

Explaining what is meant by the term "commercial fertilizers" the law says:

"The term 'commercial fertilizers' shall be construed to mean any and every substance imported, manufactured, prepared or sold for fertilizing or manuring or soil amendment purposes, except barnyard manure and stable manure which have not been artificially treated or manipulated, marl and lime. Cottonseed meal, rapeseed meal, castor pomace and all other vegetable products used as fertilizers, including the ashes of cotton hulls and wood ashes, shall be included as fertilizers within the meaning of this act and separate analysis fees shall be paid on each different grade which is sold or offered for sale in the state. The person responsible for paying the fees above prescribed may deduct from the total tonnage sold such sales of cottonseed meal or other vegetable products as are made to anyone who gives a written certificate on a form supplied by the Connecticut Agricultural Experiment Station stating that the material bought by him was to be used exclusively for feed and not for fertilizer."

Cottonseed meal is a fertilizer within the meaning of the Statute but it is provided that when this product is sold for feeding purposes only, it shall be exempt from the tonnage tax.

The status of cottonseed meal under the fertilizer law has been clearly stated in a bulletin[1] from this Station from which the following may be quoted:

Registration and analysis fees. "Each brand of cottonseed meal must be registered on forms provided by this Station and an analysis fee of ten dollars paid on it before it is sold, offered or exposed for sale, and on the first day of January annually thereafter.

"A distinctive name constitutes a distinct brand. If shipments have different guaranties of composition they are held to be different brands."

---

[1] Bull. of Information No. 9, 1919.

Branding or tagging. "Since nitrogen is the only fertilizer ingredient considered in the trade in cottonseed meal no guaranty of phosphoric acid or potash is required. If either is guaranteed by the manufacturer, however, an additional fee of ten dollars must be paid on each element. The statement of composition now legal for feeds may be used hereafter if the precentage of nitrogen is stated.

"Note that the law regarding feeding stuffs forbids the use of metal in attaching tags and requires that each package shall be branded or tagged with the statement required by law."

Duties of shippers. "It is assumed from correspondence with shippers outside the state that they will register the brands which they sell in Connecticut, will pay analysis fees as has been done in the past by manufacturers of commercial fertilizers, and will semi-annually thereafter pay the tonnage fees.

"They will report to this Station their total sales and, if they wish, may report what part has been sold for feed exclusively. From the reports of dealers within the state it will be possible to determine quite closely the amounts of each brand actually used as feed.

"In the case the jobber outside the state neglects or refuses to register a brand, the dealer who sells it within the state is responsible under the law."

Duties of dealers. "Dealers are required to file with the director of the Station on July first of each year and semi-annually thereafter a sworn statement of their total sales of each brand of cottonseed meal and the amount of each sold exclusively for feed, during the preceding six months."

Requirements to be Complied with by Sellers of Commercial Fertilizers.

The seller is responsible for the proper labeling of each package, for the registration at the Station of every brand sold by him and for the payment of the analysis fee, before offering for sale, and annually thereafter on January 1st.

The seller must also, on the 1st of January and July, report the tonnage of fertilizer sold within the preceding six months and pay to the director of the Station a tonnage fee of 6 cents per ton.

On request, copies of the law and blanks for registration and for tonnage reports wlll be supplied by the Station.

If, however, proper labeling, registration and payments have been provided for by the manufacturer of the brands or by another responsible person, all sellers of such brands are released from the above mentioned requirements. The retailer, therefore, should assure himself that the requirements of the law have been met by the manufacturers of the brands which he handles, or himself be prepared to meet all these requirements.

Precautions to be Observed in Drawing Samples for Analysis.

The analysis of a fertilizer is of no value unless the sample analyzed represents as nearly as possible the stock from which the sample was drawn. The law prescribes the procedure to be followed by authorized agents of this Station when taking official samples for analysis as follows:

"When samples are taken from fertilizers in bags, a tube shall be used, and it shall be inserted at one end of the bag and shall pass substantially the entire length of the bag, so as to take a core of the material being sampled from substantially the entire length of the bag. Samples thus taken from individual bags shall be thoroughly mixed, and the official samples shall be taken from the mixture so drawn by the method known as 'quartering.' Samples of fertilizer taken as herein provided shall be taken from at least five per centum of the separate original unopened packages in the lot, for the mixture from which the official samples shall be taken. If less than one hundred bags are in the lot, at least five bags shall be sampled; if less than five bags, all shall be sampled. Broken packages shall not be sampled."

The Station is called upon each year to analyze a large number of samples, drawn and submitted by individuals, representing fertilizers bought by them for their own use. The purpose of the sender is to find out whether the mixture contains the amounts of plant food which are guaranteed, and, if it does not, to secure evidence upon which to base a claim against the seller for the shortage. *It is, therefore, necessary that the sample be taken essentially in the way prescribed by law and in the presence of a witness so that there can be no question about the fairness of the sample.* The Station will supply to any applicant a form upon which the sender should give the necessary information and submit it with the sample. This makes the sample of public interest and value, which is the only justification for doing the work at State expense; and it is also the sender's protection in case the validity of the sample is questioned.

REGISTRATIONS.

Late Registrations for 1922.

To the brands registered for 1922 in our last report should be added:

Atlantic Packing Co., New Haven, Conn.
Dry Ground Fish

Marianna Cotton Oil Co., Inc., Memphis, Tenn.
White Mule Brand 36% Protein Cotton Seed Meal
White Mule Brand 41% Protein Cotton Seed Meal
White Mule Brand 43% Protein Cotton Seed Meal

Registrations for 1923.

For 1923, 61 individuals and firms registered at this Station for sale in this State 436 brands of fertilizers. As required by Statute the brands so registered are listed as follows:

American Agricultural Chemical Co., 2 Rector St., New York, N. Y.
Agrico Tobacco Manure
Castor Pomace
Complete Potato Mixture
Crescent Complete Manure
Double A Tobacco Fertilizer
Double Manure Salts

Dry Ground Fish, 8-6
Dry Ground Fish, 10-6
Fine Ground Bone
Fish and Potash
Five Four Three Tobacco Fertilizer
Grass and Lawn Top Dressing
Ground Tankage
High Grade Acid Phosphate
Muriate of Potash
Nitrate of Soda
Pulverized Sheep Manure
7% Potash Fertilizer
Sulphate of Ammonia
Sulphate of Potash
Universal Phosphate
Bradley's Complete Manure for Potatoes and Vegetables
Bradley's Complete Manure for Top Dressing Grass and Grain
Bradley's Complete Tobacco Manure
Bradley's Corn Phosphate
Bradley's Fish Compound
Bradley's New Method Fertilizer
Bradley's Potato Manure
Bradley's Potato Fertilizer
Bradley's Superior Tobacco Compound
Bradley's Valley Tobacco Fertilizer
Bradley's XL Superphosphate of Lime
Listers Celebrated Tobacco Fertilizer
Listers Complete Tobacco Manure
Listers Corn and Potato Fertilizer
Listers Eastern Pride Fertilizer
Listers Potato Manure
Listers Squirrel Brand Fertilizer
Listers Standard Pure Superphosphate of Lime
Listers Success Fertilizer
National Complete Tobacco Fertilizer
National Eureka Potato Fertilizer
National Market Garden Fertilizer
National Potato and Corn Phosphate
National Premier Truck Manure
National Special Tobacco
National Top Dressing Compound
National Universal Phosphate
National XXX Fish and Potash
National White Ash Tobacco Grower
Quinnipiac Climax Phosphate
Quinnipiac Corn Manure
Quinnipiac Fish and Potash Phosphate
Quinnipiac Market Garden Manure
Quinnipiac Phosphate
Quinnipiac Potato Phosphate
Quinnipiac Prime Tobacco Manure
Quinnipiac Seed Leaf Tobacco Manure
Quinnipiac Superior Top Dressing Manure
Quinnipiac Wrapper Leaf Brand Tobacco Manu
Wheeler's Ammoniated Fish Manure
Wheeler's Corn Fertilizer
Wheeler's Cuban Tobacco Grower
Wheeler's Early Market Compound
Wheeler's Potato Manure
Wheeler's Royal Wheat Grower
Wheeler's Universal Mixture

American Cotton Oil Co., 65 Broadway, New York, N. Y.

"Aco" Brand Cotton Seed Meal
Longhorn Brand Cotton Seed Meal
Surety Brand Cotton Seed Meal

Apothecaries Hall Co., Waterbury, Conn.

Acid Phosphate
Animal Tankage
Bone and Meat Tankage
Bone Meal
Castor Pomace
Fish
Liberty Corn, Fruit and All Crops
Liberty Fish, Bone and Potash
Liberty High Grade Market Gardeners
Liberty High Grade Tobacco Special
Liberty Market Gardeners Special
Liberty Tobacco Special
Liberty Top Dresser for Grass and Grain
Muriate Potash
Nitrate Potash
Nitrate Soda
Precipitated Bone
Sulphate Potash

Armour Fertilizer Works, 305 Broadway, New York, N. Y.

Armour's Big Crop Acid Phosphate 16%
Armour's Big Crop Fertilizer 8-6-6
Armour's Big Crop Fertilizer 5-8-5
Armour's Big Crop Fertilizer 5-8-7
Armour's Big Crop Fertilizer 4-8-4
Armour's Big Crop Fertilizer 4-6-10
Armour's Big Crop Fertilizer 3-8-4
Armour's Big Crop Fertilizer 2-12-2
Armour's Big Crop Tobacco Special 5-4-5
Armour's Corn Grower 2-8-2
Armour's Nitrate of Soda
Bone Meal 3-48
Ground Tankage 9-15
Muriate of Potash
Raw Bone Meal 4½-47
Sheep Manure

Ashcraft-Wilkinson Co., Trust Co. of Georgia Bld

Helmet Brand Prime Cotton Seed Meal
Monarch Brand Prime Cotton Seed Meal
Paramount Brand Good Cotton Seed Meal

Atlantic Grass Seed Co., Inc., 46 West Broadway, New York, N. Y.

Wonderlawn Grass Grower

Atlantic Packing Co., New Haven, Conn.

Atlantic 5-8-7
Atlantic 4-8-6
Atlantic Grain Fertilizer 2-8-2
Atlantic Potato Phosphate 3-8-4
Atlantic Special Vegetable 4-8-4
Atlantic Tobacco Grower 5-4-5
Atlantic Tobacco Manure 5-8-6

Baker Castor Oil Co., 120 Broadway, New York, N. Y.
Castor Pomace

Barrett Co., 40 Rector St., New York, N. Y.
Arcadian Sulphate of Ammonia

Berkshire Fertilizer Co., Bridgeport, Conn.
Acid Phosphate
Berkshire Ammoniated Bone Phosphate
Berkshire Complete Fertilizer
Berkshire Complete Tobacco
Berkshire 5-8-7
Berkshire Grass Special
Berkshire Market Garden
Berkshire Potato and Vegetable
Berkshire Tobacco Special
Berkshire Tobacco Starter
Castor Pomace
Double Manure Salts
Dry Ground Fish
Fine Ground Bone
Ground Sheep Manure
Muriate of Potash
Nitrate of Soda
Sulphate of Potash

Blish Hardware Co., F. T., South Manchester, Conn.
Complete Market Garden
Complete Tobacco Fertilizer
Potato Phosphate
Top Dressing for Grass

Boardman, F. E., Middletown, Conn.
Boardman's Fertilizer for Potatoes and General Crops
Boardman's Tobacco Fertilizer

Bowker Fertilizer Co., 60 Trinity Place, New York, N. Y.
Bowker's All Round Fertilizer
Bowker's Connecticut Valley Tobacco Fertilizer
Bowker's Corn, Grain and Grass Phosphate
Bowker's Fisherman's Brand Fish and Potash
Bowker's Market Garden Fertilizer
Bowker's Potato and Vegetable Phosphate
Bowker's 16% Acid Phosphate
Bowker's Square Brand Farm and Garden Phosphate
Bowker's Sure Crop Phosphate
Stockbridge Early Crop Manure
Stockbridge Potato and Vegetable Manure
Stockbridge Premier Tobacco Grower
Stockbridge Tobacco Manure
Stockbridge Top Dressing and Forcing Manure
Stockbridge Truck Manure

Bridge's Sons, Inc., Amos D., Hazardville, Conn.
Corn, Onion and Potato and General Purpose
Special Tobacco Fertilizer

Brodé Corporation, F. W., 119 Madison Ave., Memphis, Tenn.
"Owl Brand 36%" Cotton Seed Meal
"Owl Brand 43%" High Grade Cotton Seed Meal

Buckeye Cotton Oil Co., Cincinnati, Ohio.
"Buckeye" Good Cotton Seed Meal Good Quality

Chittenden Co., E. D., Bridgeport, Conn.
Chittenden's Acid Phosphate
Chittenden's Castor Pomace
Chittenden's Complete Grain
Chittenden's Dry Ground Fish
Chittenden's Ground Bone 3-50
Chittenden's High Grade Tobacco
Chittenden's Nitrate of Soda
Chittenden's Potato Special 4% Potash
Chittenden's Potato Special 6% Potash
Chittenden's Tobacco Special

Clark Seed Co., Everett B., Milford, Conn.
Clark's 3-8-2
Clark's 4-8-4
Clark's Special Mixture with 6% Potash
Nitrate of Soda
Special Mixture Tip Top Brand
16% Acid Phosphate

Coe-Mortimer Co., 2 Rector St., New York, N. Y.
Country Club Golf and Lawn Fertilizer "Brand A"
Country Club Golf and Lawn Fertilizer "Brand B"
E. Frank Coe's Celebrated Special Potato Fertilizer
E. Frank Coe's Columbian Corn and Potato Fertilizer
E. Frank Coe's Connecticut Wrapper Grower
E. Frank Coe's Fish and Potash Guano
E. Frank Coe's Gold Brand Excelsior Guano
E. Frank Coe's New Englander Special
E. Frank Coe's Red Brand Excelsior Guano
E. Frank Coe's 16% Superphosphate
E. Frank Coe's Special Grass Top Dressing
E. Frank Coe's Standard Potato Fertilizer
E. Frank Coe's Sure Burn Tobacco Grower
E. Frank Coe's Tobacco Leaf Fertilizer

Connecticut Fat Rendering & Fertilizing Corp., West Haven, Conn.
Tankage

Consolidated Rendering Co., 40 North Market St., Boston, Mass.
Ground Bone (3-24)
Ground Bone (2.5-26)
High Grade Acid Phosphate
Muriate Potash
Nitrate Soda
Sulphate Ammonia
Sulphate Potash
Tankage 6-30
Tankage 9-20

Consumers Chemical Corporation, 120 Broadway, New York, N. Y.

Kainit
Nitrate of Soda

DuPont de Nemours & Co., E. I., Wilmington, Del.

Nitrate of Soda

Eastern States Farmers' Exchange, 292 Worthington St., Springfield

Eastern States 2-8-2
Eastern States 4-8-4
Eastern States 4-8-7
Eastern States 3-12-3 No-Filler
Eastern States 5-8-7 No-Filler
Eastern States 5-10-5 No-Filler
Eastern States 7-8-3 No-Filler
Eastern States 16% Acid Phosphate
Eastern States Ground Tankage 7-15
Eastern States Muriate of Potash
Eastern States Nitrate of Soda
Eastern States Formula A
Eastern States Formula B
Eastern States Formula C

Essex Fertilizer Co., 39 North Market St., Boston, Mass.

Essex Fish Fertilizer for All Crops 3-8-4
Essex Market Garden for Potatoes, Roots and Vegetables 4-8-4
Essex Potato Phosphate for Potatoes and Vegetables 4-8-7
Essex 2-8-2 for Farm and Garden
Essex 4-6-10 for Potatoes and Vegetables
Essex Tobacco Manure 5-4-5
Essex Tobacco Manure 5-8-6

Frisbie Co., L. T., New Haven, Conn.

Castor Pomace
Dry Ground Fish
Frisbie's Bone Meal
Frisbie's Corn and Grain Fertilizer 2-8-2
Frisbie's 5-8-7
Frisbie's 5-10-5
Frisbie's Market Garden 4-8-6
Frisbie's Special 3-8-4
Frisbie's Special Vegetable and Potato Grower 4-8-4
Frisbie's Tobacco Grower 5-4-5
Frisbie's Tobacco Manure 5-8-6
Frisbie's Top Dresser 7-5-4

Humphreys-Godwin Co., Inc., Memphis, Tenn.

Bull Brand Cotton Seed Meal.
Danish Brand Cotton Seed Feed
Dixie Brand Cotton Seed Meal

International Agricultural Corporation (Buffalo Fertilizer Works), 1 St., Boston, Mass.

Buffalo Complete Tobacco
Buffalo Economy
Buffalo High Grade Manure
Buffalo New England Special
Buffalo Tobacco Producer
Buffalo Top Dresser and Starter

Jones Phosphate Co., Robin, Nashville, Tenn.
Ground Rock Phosphate

Joynt, John, Lucknow, Ontario, Canada
The Joynt Brand Canada Unleached Hardwood Ashes

Lovitt & Co., L. B., Memphis, Tenn.
"Lovitt Brand" Cotton Seed Meal
"Neal's Choice" Cotton Seed Meal
"Thirty-Six Brand" Cotton Seed Meal

Lowell Fertilizer Company, 40 North Market St.,
Lowell Animal Brand 3-8-4
Lowell Bone Fertilizer 2-8-2 for Corn, Grain, Grass and Veg
Lowell 5-8-7 for Potatoes and Vegetables
Lowell 4-8-4 for Potatoes, Corn and Vegetables
Lowell 4-6-10 for Potatoes and Vegetables
Lowell Tobacco 5-4-5 for Tobacco, Fruits and Vines
Lowell Tobacco Manure 5-8-6
Lowell Potato Phosphate for Potatoes and Vegetables 4-8-7
Lowell Top Dressing 7-5-2

Mapes Formula & Peruvian Guano Co., 143 Liberty St., New York
The Mapes Connecticut Valley Special
The Mapes Corn Manure
The Mapes C. S. Tobacco Manure
The Mapes General Tobacco Manure
The Mapes General Truck Manure
The Mapes General Use Manure
The Mapes Grain Brand
The Mapes Onion Manure
The Mapes Potato Manure
The Mapes Tobacco Ash Constituents
The Mapes Tobacco Manure Wrapper Brand
The Mapes Tobacco Starter Improved
The Mapes Top Dresser

Marianna Sales Co., Falls Building, Memphis, Tenn.
White Mule Brand 36% protein Cottonseed Meal
White Mule Brand 41% protein Cottonseed Meal
White Mule Brand 43% protein Cottonseed Meal

Meech & Stoddard, Inc., Middletown, Conn.
Bixota 5-8-7
Bixota 4-8-4
Bixota 3-8-3
Bixota 2-8-2

Mitchell, Walter L., 699 Forest St., New Haven, Conn.
Mitchell's 16% Acid Phosphate
Mitchell's Phosphoflour
Mitchell's Two-Speed Phosphate

Natural Guano Co., Aurora, Illinois.
"Sheep's Head" Pulverized Sheep Manure

Nature's Plant Food Company of Maine, 43 Commercial St., Boston
Nature's Plant Food

Neal & Company, Inc., R. N., Memphis, Tenn.
"Triangle" 41% Cottonseed Meal

New England Fertilizer Company, 40A North Market St., Boston, M
New England Corn Phosphate 2-8-2 for Grain and Vegetables
New England 4-8-4 for Potatoes and Vegetables
New England Superphosphate 3-8-4
New England Potato Phosphate 4-8-7 for Potatoes and Vegetab
New England Tobacco 5-4-5 for Tobacco, Fruits and Vines
New England Tobacco Manure 5-8-6
New England 2-8-3 for Vegetables and Grain

Nitrate Agencies Company, 85 Water St., New York, N. Y.
Naco Brand Acid Phosphate
Naco Brand Castor Pomace
Naco Brand Fish
Naco Brand Muriate of Potash
Naco Brand Nitrapo
Naco Brand Nitrate of Soda
Naco Brand Number 7
Naco Brand Number 12 Peruvian Guano Mixture
Naco Brand Number 14 Peruvian Guano Mixture
Naco Brand Number 19 Peruvian Guano Mixture
Naco Brand Number 24 Peruvian Guano Mixture
Naco Brand Peruvian Guano
Naco Brand Raw Bone
Naco Brand Steamed Bone
Naco Brand Sulphate of Ammonia
Naco Brand Sulphate of Potash
Naco Brand Tankage

Nothern, W. C., Box 414, Memphis, Tenn.
Bee Brand Cottonseed Meal

Olds & Whipple, Inc., Hartford, Conn.
Double Manure Salts
High Grade Sulphate of Potash
Nitrate of Soda
O & W Acid Phosphate
O & W Bone Phosphate and Potash Compound
O & W Castor Pomace
O & W Complete Corn, Onion and Potato Fertilizer
O & W Complete Corn, Potato and Onion Fertilizer
O & W Complete Tobacco Fertilizer
O & W Dry Ground Fish
O & W Fish and Potash
O & W H G Starter and Potash Compound
O & W High Grade Potato Fertilizer
O & W High Grade Tobacco Starter
O & W Precipitated Bone
O & W Pure Bone Meal
O & W Top Dressing
Sulphate of Ammonia

Pacific Manure & Fertilizer Company, 429 Davis St., San Francisco,
Groz-It Brand Pulverized Sheep Manure

Parmenter & Polsey Fertilizer Company, 41 North Market St., Bosto
- Parmenter & Polsey 5-4-5 for Tobacco, Fruit and Vines
- Parmenter & Polsey 4-8-4 for Potatoes, Corn and Vegetables
- Parmenter & Polsey Plymouth Rock Brand 3-8-4 for all Crops
- Parmenter & Polsey Potato Phosphate for Potatoes and Vegetab
- Parmenter & Polsey 2-8-2 for Farm and Garden

Phoenix Cotton Oil Co., Memphis, Tenn.
- Phoenix 36% protein Cotton Seed Meal
- Phoenix 41% protein Cotton Seed Meal
- Phoenix 43% protein Cotton Seed Meal

Platt Company, The Frank S., New Haven, Conn.
- Platco Special 4-8-6

Potash-Marl, Inc., 15 East 40th St., New York, N. Y.
- Potash-Marl

Premier Poultry Manure Company, 431 So. Dearborn St., Chicago, Il
- Premier Brand Pulverized Poultry Manure.

Pulverized Manure Company, 828 Exchange Ave., Union Stock Yar cago, Ill.
- Wizard Brand Manure
- Wizard Brand Sheep Manure

Rogers & Hubbard Company, The, Portland, Conn.
- Acid Phosphate
- Castor Pomace
- Cotton Seed Meal
- Garden Fertilizer
- Ground Fish
- Hubbard's "Bone Base" Fertilizer for Oats and Top Dressing
- Hubbard's "Bone Base" Fertilizer for Seeding Down
- Hubbard's "Bone Base" Soluble Corn and General Crops Manur
- Hubbard's "Bone Base" Soluble Potato Manure
- Hubbard's Pure Raw Knuckle Bone Flour
- Hubbard's Strictly Pure Fine Bone
- Nitrate of Soda
- Rogers & Hubbard's All Soils—All Crops Fertilizer
- Rogers & Hubbard's Climax Tobacco Brand
- Rogers & Hubbard's Corn and Grain Fertilizer
- Rogers & Hubbard's High Potash Fertilizer
- Rogers & Hubbard's Potato Fertilizer
- Rogers & Hubbard's Soluble Tobacco Manure
- Rogers & Hubbard's Tobacco Grower, Vegetable Formula
- Sulphate of Ammonia
- Sulphate of Potash

Royster Guano Company, F. S., 1604 Munsey Building, Baltimore, Md
- Dry Ground Fish
- Muriate of Potash
- Nitrate of Soda
- Royster's Bully Guano
- Royster's Fine Ground Bone Meal
- Royster's Fish, Flesh and Fowl

Royster's Pure Raw Bone Meal
Royster's Quality Trucker
Royster's 16% Acid Phosphate
Royster's Top Dresser
Royster's Trucker's Delight
Royster's Valley Tobacco Formula
Sulphate of Potash

Sanderson Fertilizer & Chemical Co., New Haven, Conn.

Sanderson's Acid Phosphate
Sanderson's Atlantic Coast Bone, Fish and Potash
Sanderson's Castor Pomace
Sanderson's Complete Tobacco Grower
Sanderson's Corn Superphosphate
Sanderson's Dry Ground Fish
Sanderson's Fine Ground Bone
Sanderson's Formula A
Sanderson's Formula B
Sanderson's Kelsey's Bone, Fish and Potash
Sanderson's Nitrate of Soda
Sanderson's Potato Manure
Sanderson's South American Sheep and Goat Manure
Sanderson's Tobacco Grower
Sanderson's Top Dressing for Grass and Grain

Shoemaker & Co., Inc., M. L., Venango St. and Delaware Ave., Philad Pa.

Swift-Sure Bone Meal
Swift-Sure Cotton Seed Mixture
Swift-Sure Super Phosphate Crop Grower
Swift-Sure Super Phosphate Potato No. 1
Swift-Sure Super Phosphate Tobacco and General Use
Swift-Sure Super Phosphate Tobacco Starter

Springfield Rendering Company, Springfield, Mass.

Springfield Animal Brand, 3-8-4
Springfield 4-8-6
Springfield Market Garden Grower and Top Dresser 5-8-7
Springfield Special Potato, Onion and Vegetable 4-8-4
Springfield Tobacco Special, 5-4-5

Virginia-Carolina Chemical Company, 120 Broadway, New York, N. Y.

V-C Aroostook Potato Grower
V-C Champion Brand
V-C Double Owl Brand
V-C Eureka Brand
V-C Fish, Phosphate and Potash Brand
V-C Indian Chief Brand
V-C Olympic Brand
V-C Owl Brand
V-C Perfection Brand
V-C Plymouth Brand
V-C Royal Brand
V-C Tip Top Brand
V-C Universal Brand

Westervelt & Co., A. C., Memphis, Tenn.

Sun Brand Cottonseed Meal

Whitman & Pratt Rendering Co., Boston, Mass.
Whitman & Pratt's 4-8-4 Brand

Wilcox Fertilizer Company, Mystic, Conn.
Wilcox Acid Phosphate
Wilcox Corn Special
Wilcox Dry Ground Fish
Wilcox Fish and Potash
Wilcox 5-8-7 Fertilizer
Wilcox 4-8-4 Fertilizer
Wilcox Grass and Truck Fertilizer
Wilcox Ground Packing-House Tankage
Wilcox Ground Steamed Bone
Wilcox Nitrate of Soda
Wilcox Potato and Vegetable Phosphate
Wilcox Tobacco Special

S. D. Woodruff & Sons, Orange, Conn.
"Woodruff's Home Mixed"

Worcester Rendering Company, Auburn, Mass.
Prosperity Brand Complete Dressing
Prosperity Brand Corn and Grain Fertilizer
Prosperity Brand Ground Tankage
Prosperity Brand Market Garden
Prosperity Brand Potato and Vegetable Fertilizer

INSPECTION OF 1923.

During the year, Mr. Churchill, the sampling agent of the Station, has visited 93 towns and villages in the State and has taken 548 official samples of fertilizers which number includes all the registered brands which were found on sale. These together with samples submitted by purchasers or others interested may be classified as follows:

CLASSIFICATION OF FERTILIZERS ANALYZED.

	Nnmber of Samples	Page
I. *Containing nitrogen as the chief active ingredient:*		
Nitrate of soda	24	17
Sulphate of ammonia	9	17
Castor pomace	71	20
Cottonseed meal	179	20
Linseed meal	3	33
II. *Containing phosphoric acid as the chief active ingredient:*		
Raw rock phosphate	1	33
Precipitated bone phosphate	16	33
Dissolved rock phosphate or acid phosphate	21	35
III. *Containing potash as the chief active ingredient:*		
Carbonate of potash	4	38
Muriate of potash	8	38
High-grade sulphate of potash	13	38
Kainit	1	38
Double sulphate of potash and magnesia	11	42
IV. *Containing nitrogen and potash:*		
"Nitrapo," etc	4	42
V. *Containing nitrogen and phosphoric acid:*		
Dry ground fish	49	43
Tankage	10	48
Ground bone	28	49
VI. *Mixed fertilizers:*		
Containing phosphoric acid and potash	2	52
Containing nitrogen and phosphoric acid	7	54
Containing nitrogen, phosphoric acid and potash	270	54
Special and home mixtures	26	82
VII. *Miscellaneous fertilizers, amendments, waste products, etc.:*		
Wood ashes	16	83
Sheep manure, etc	8	83
Potash-Marl	1	86
Limestone, etc	4	86
Peat or muck	4	87
Sewage sludge	2	87
Miscellaneous	67	88
Total	859	

I. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN.

NITRATE OF SODA.

Twenty-four samples were examined and results are given in Table I.

Chemically pure nitrate of soda contains 16.47 per cent. of nitrogen but commercial nitrate of soda or "Chili saltpeter" contains from 15 to 16 per cent. which is equivalent to 91 to 97 per cent. nitrate of soda. The impurities in the commercial article are chiefly common salt and water. Plants respond quickly to nitrogen in this form because it is directly assimilable. The residue which nitrate of soda leaves in the soil is alkaline.

At the prices quoted for this material, nitrogen has cost from 17.2 cents to 24.4 cents per pound, the average cost being 20.6 cents.

SULPHATE OF AMMONIA.

Nine samples were analyzed and the results are given in Table II.

21235. Sold by Apothecaries Hall Co., Waterbury. Sent by Hatheway & Steane, Hartford.

20972. Sold by The Barrett Co., New York. Sent by Hatheway & Steane, Hartford.

21175. Sold by The Barrett Co., New York. Sent by Berkshire Fertilizer Co., Bridgeport.

21276. Sold by American Agricultural Chemical Co., New York. Stock of M. H. Edwards, Collinsville.

21056. Sold by Olds & Whipple, Inc., Hartford. Stock of Harold M. Newberry, East Windsor Hill.

21427. Sold by Olds & Whipple, Inc., Hartford. Sampled at the factory.

20883. Sold by The Barrett Co., New York. Sent by Hatheway & Steane, Hartford.

20922. Sold by Consolidated Rendering Co., Boston. Sampled at the factory, New Haven.

21463. Sold by The Rogers & Hubbard Co., Portland. Sampled at the factory.

TABLE I. ANALYSES OF NITRATE OF SODA.

Station No.	Manufacturer or Jobber.	Purchased, Sampled or Sent by	Per cent Nitrogen. Guaranteed.	Per cent Nitrogen. Found.
20450	W. L. Grace Co., New York	American Sumatra Tobacco Co., Bloomfield	15.00	15.96
20451	W. L. Grace Co., New York	American Sumatra Tobbaco Co., Bloomfield	15.00	15.98
20452	W. L. Grace Co., New York	American Sumatra Tobacco Co., Bloomfield	15.00	16.00
21031	Apothecaries Hall Co., Waterbury	J. E. Shepard, So. Windsor.	15.00	15.54
21159	L.T. Frisbie, New Haven	A. E. Plant Sons Co., Branford	15.63	15.64
20951	Sanderson Fertilizer and Chemical Co., New Haven	Station Agent at the factory	15.00	15.54
21250	Manufacturer unknown.	Walter T. Clark, County Agent, Norwich	.....	15.40
20906	Berkshire Fertilizer Co., Bridgeport	Station Agent at the factory	14.80	15.78
20956	Apothecaries Hall Co., Waterbury	Conn. School for Boys, Meriden	15.00	15.54
21279	E. B. Clark Seed Co., Milford	Station Agent at the factory	.....	15.38
20936	The Rogers & Hubbard Co., Portland	Station Agent at the factory	15.00	15.92
21243	Olds & Whipple, Inc., Hartford	Harold M. Newberry, East Windsor Hill	.....	15.92
20942	Olds & Whipple, Inc., Hartford	Station Agent at the factory	15.00	15.44
21004	Olds & Whipple, Inc., Hartford	Harold M. Newberry, East Windsor Hill	15.00	15.44
21300	Eastern States Farmers' Exchange, Springfield.	C. M. Beeman, Granby	14.80	14.96
21474	F. S. Royster Guano Co., Baltimore	Plumb Bros., Waterbury	15.00	15.62
21286	E. D. Chittenden Co., Bridgeport	J. E. Stoddard, Abington.	15.00	15.52
20908	Apothecaries Hall Co., Waterbury	Station Agent at the factory	15.00	15.08
21540	Consumers Chemical Corp., New York	E. O. Chapman, No. Haven	14.80	15.48

TABLE I. ANALYSES OF NITRATE OF SODA—*Concluded.*

Manufacturer or Jobber.	Purchased, Sampled or Sent by	Per cent Nitrogen.		Cost per ton.	Nitrogen costs
		Guaranteed.	Found.		
American Agricultural Chemical Co., New York..............	Bristol Grain & Supply Co., Bristol..................	15.00	15.60	$75.00	24.
Armour Fertilizer Works, New York...........	John O. Fox, Putnam......	14.81	15.18	74.00	24.
Manufacturer unknown.	The Meriden Farmers' Exchange, Meriden........	....	15.29	......	...
Consolidated Rendering Co., Boston..........	Station Agent at the factory, New Haven............	15.50	15.20	......	...
Wilcox Fertilizer Co., Mystic..............	Station Agent at the factory	15.00	15.36	......	...

TABLE II. ANALYSES OF SULPHATE OF AMMONIA.

Station No.	Per Cent of Nitrogen Guaranteed.	Found.	Cost per ton.	Nitrogen costs cents per pound.
21235	....	21.00	$70.00	16.7
20972	....	20.78	70.00	16.8
21175	20.75	21.00	80.00	19.0
21276	20.16	20.60	80.00	19.4
21056	20.56	20.92	83.60	20.0
21427	20.56	20.78	83.60	20.1
20883	20.75	21.00	....	...
20922	20.50	20.56	....	...
21463	20.50	20.54	....	...

Pure ammonium sulphate contains 21.2 per cent of nitrogen, ut the article of commerce usually contains about 20.5 per cent. 'our of the samples examined this year were of a high degree of urity containing, or closely approaching, 21 per cent.

Like nitrate of soda, ammonium sulphate is readily soluble in vater and quickly diffuses through the soil. Since it does not each out from the soil so rapidly as does nitrate of soda and ecause its assimilation by plants is somewhat slower it has an dvantage over nitrate of soda in wet seasons and it sustains rowth over a longer period.

Prices, so far as quoted to us, ranged from $70 to $83.60 per ton aking the cost of nitrogen per pound from 16.7 cents to 20.1 cents he average being 18.7 cents.

CASTOR POMACE.

Seventy-one samples have been analyzed and results are given in Table III.

Castor pomace is the residue left after extracting the oil from the castor bean. Live stock will eat the pomace greedily and since it contains a deadly poison care should be taken not to store it where it will be accessible to farm animals.

This material has been used in increasing quantities in the last two years as a source of organic nitrogen in mixed fertilizers as a supplement to cottonseed meal. It contains from 4.5 to 5.5 per cent of nitrogen the availability of which is about equal to that of dried blood and cottonseed meal. Besides nitrogen, it contains on the average about 1 per cent of potash (K_2O), and 2 per cent of phosphoric acid (P_2O_5), the latter largely or entirely available.

The average nitrogen content of samples analyzed during the past year is 5.1 per cent and the average ton price, so far as prices are recorded with us confidentially or otherwise, is $34.51. *Thus the cost of nitrogen per pound in this material has been 33.8 cents, no allowance being made for the phosphoric acid and potash which it contains.*

COTTONSEED MEAL.

The standard commercial grades of cottonseed meals used for feeding purposes, and the grades chiefly sold for fertilizer, are guaranteed as follows:

36 per cent protein containing *5.76 per cent nitrogen* equivalent to *7.00 per cent ammonia.*

41 per cent protein containing *6.56 per cent nitrogen* equivalent to *8.00 per cent ammonia.*

43 per cent protein containing *6.88 per cent nitrogen* equivalent to *8.3 per cent ammonia.*

One hundred and seventy-nine samples of cottonseed meal have been analyzed and results are given in Table V. These samples belong largely to the three groups just named. Three have odd guaranties and in twelve cases no statement of guaranty could be secured.

Information as to prices was not afforded in some cases and in others it was confidential, but the cost per pound of nitrogen has been calculated based upon the average of such ton prices as were quoted to us whether confidentially or otherwise.

Samples which failed to meet their guaranties by more than 0.1 per cent of nitrogen (equivalent to 0.63 per cent of protein), are noted in the subjoined summary as deficient. If a tolerance of 1 per cent protein (0.16 per cent nitrogen), is allowed the number of deficient samples is somewhat reduced viz. to 29.

These data appear in summary form in Table IV.

Table III. Analyses of Castor Pomace.

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed.	Cost per ton.
	The American Agricultural Chemical Co., New York City.				
20996	....	Station Agent from Geo. S. Phelps & Co., Thompsonville..................	4.99	4.53	$39.00
	Apothecaries Hall Co., Waterbury, Conn.				
20772	N. Y., N. H. & H. R. R. 75598.............	Spencer Bros., Inc., Suffield..	5.11	4.52	34.00
20773	48664...............	Spencer Bros., Inc., Suffield..	4.88	4.52	34.00
20855	33443...............	Hatheway & Steane, Hartford	5.72	4.52	31.75
20856	67113...............	Hatheway & Steane, Hartford	4.88	4.52	31.75
20881	516550..............	Hatheway & Steane, Hartford	5.27	4.52	.....
20882	51578...............	Hatheway & Steane, Hartford	5.79	4.52	.....
20899	P. & R. 16482........	Spencer Bros., Inc., Suffield..	5.10	4.52	34.00
20900	L. & N. 95777.........	Spencer Bros., Inc., Suffield..	4.57	4.52	34.00
20973	101264..............	Hatheway & Steane, Hartford	5.24	4.52	31.75
21041	....	Station Agent from J. P. Norton, Broad Brook........	4.70	4.52	32.50
	Baker Castor Oil Co., New York City.				
20442	534799..............	American Sumatra Tobacco Co., Bloomfield..........	4.33	4.52	.....
20443	87488...............	American Sumatra Tobbaco Co., Bloomfield..........	5.91	4.52	.....
20444	561220..............	American Sumatra Tobbaco Co., Bloomfield..........	4.84	4.52	.....
20445	3511................	American Sumatra Tobacco Co., Bloomfield..........	4.95	4.52	.....
20446	160747..............	American Sumatra Tobacco Co., Bloomfield..........	5.95	4.52	.....
20447	28397...............	American Sumatra Tobacco Co., Bloomfield..........	6.30	4.52	.....
20448	303027..............	American Sumatra Tobacco Co., Bloomfield..........	5.15	4.52	.....
20449	20267...............	American Sumatra Tobacco Co., Bloomfield..........	5.62	4.52	.....
20517	90623...............	American Sumatra Tobacco Co., Bloomfield..........	4.88	4.52	.....
20518	556528..............	American Sumatra Tobacco Co., Bloomfield..........	4.96	4.52	.....
20519	22130...............	American Sumatra Tobacco Co., Bloomfield..........	4.79	4.52	.....

TABLE III. ANALYSES OF CASTOR POMACE—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed.	Cost per ton.
	Baker Castor Oil Co.				
20520	61212	American Sumatra Tobacco Co., Bloomfield	5.03	4.52	....
20521	10154	American Sumatra Tobacco Co., Bloomfield	4.98	4.52	....
20522	19928	American Sumatra Tobacco Co., Bloomfield	4.90	4.52	....
20523	153529	American Sumatra Tobacco Co., Bloomfield	5.19	4.52	....
20524	74483	American Sumatra Tobacco Co., Bloomfield	5.18	4.52	....
20593	81821	American Sumatra Tobacco Co., Bloomfield	4.96	....	....
20594	48966	American Sumatra Tobacco Co., Bloomfield	5.17	....	....
20595	34679	American Sumatra Tobacco Co., Bloomfield	5.18	....	....
20596	40277	American Sumatra Tobacco Co., Bloomfield	5.68	....	....
20597	535120	American Sumatra Tobacco Co., Bloomfield	5.10	....	....
20598	88536	American Sumatra Tobacco Co., Bloomfield	5.29	....	....
20599	83939	American Sumatra Tobacco Co., Bloomfield	5.38	....	....
20646	....	American Sumatra Tobacco Co., Bloomfield	5.12	....	....
20658	534842	American Sumatra Tobacco Co., Bloomfield	5.16	4.52	....
20679	22834	American Sumatra Tobacco Co., Bloomfield	5.36	4.52	....
20680	14609	American Sumatra Tobacco Co., Bloomfield	4.68	....	....
20752	85576	American Sumatra Tobacco Co., Bloomfield	5.12	4.52	....
20753	76289	American Sumatra Tobacco Co., Bloomfield	5.10	4.52	....
20754	14285	American Sumatra Tobacco Co., Bloomfield	5.14	4.52	....
20755	7568	American Sumatra Tobacco Co., Bloomfield	5.08	4.52	....
20756	83221	American Sumatra Tobacco Co., Bloomfield	4.46	4.52	....
20784	13931	American Sumatra Tobacco Co., Bloomfield	4.55	4.52	....
20997	....	Station Agent from E. J. Bantle, Glastonbury	4.44	4.50	$37.00

TABLE III. ANALYSES OF CASTOR POMACE—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed.	Cost per ton.
	Baker Castor Oil Co.				
21033	549580...............	Station Agent from J. E. Shepard, South Windsor...	4.99	4.50	$31.00
21034	114242...............	Station Agent from J. E. Shepard, South Windsor...	4.86	4.50	31.00
21035	41436...............	Station Agent from J. E. Shepard, South Windsor...	4.80	4.50	31.00
	Berkshire Fertilizer Co., Bridgeport.				
20713	32002...............	Station Agent from J. E. Shepard, South Windsor...	5.04	....	34.20
21358	....	Station Agent from Paul Rostek, Melrose............	4.99	5.00	38.00
	E. D. Chittenden Co., Bridgeport.				
21199	....	Station Agent from E. J. Bantle, Glastonbury......	5.50	4.50	36.00
	L. T. Frisbie Co., New Haven, Conn.				
20926	....	Station Agent from factory..	5.28	4.52	.....
	Olds & Whipple, Inc., Hartford, Conn.				
20867	N. Y. C. 257636.......	J. E. Shepard, South Windsor	4.54	4.50	32.40
20889	537458 and 560869.....	Clark Bros., Windsor.......	5.00	4.94	.....
20897	P. R. R. 549580.......	J. E. Shepard, South Windsor	4.18	4.50	.....
20934	P. R. R. 558771.......	Daly Bros., Warehouse Pt....	5.60	4.50	33.00
20981	20629...............	J. E. Shepard, South Windsor	5.14	4.50	31.00
20982	561351...............	J. E. Shepard, South Windsor	4.90	4.50	31.00
20983	92785...............	J. E. Shepard, South Windsor	5.03	4.50	31.00
20984	41703...............	J. E. Shepard, South Windsor	5.40	4.50	31.00
21006	....	Harold M. Newberry, East Windsor Hill............	5.21	4.94	36.10
21058	....	Harold M. Newberry, East Windsor Hill............	5.10	4.94	36.10
21076	122078...............	J. E. Shepard, South Windsor	4.99	4.94	31.00
21077	31265...............	J. E. Shepard, South Windsor	4.78	4.94	31.00
21213	....	L. Wetstone, Hartford......	5.62	4.94	36.00
21214	....	L. Wetstone, Hartford......	5.83	4.94	36.00
21244	....	Harold M. Newberry, East Windsor Hill............	5.06	4.94	34.20
21425	....	Station Agent from W. H. Carrier, Glastonbury......	5.70	4.94	36.00

TABLE III. ANALYSES OF CASTOR POMACE—*Concluded.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed.	Cost per ton.
	The Rogers & Hubbard Co., Portland.				
20937	....	Station Agent from factory...	4.84	5.10	$38.00
	Sanderson Fertilizer & Chemical Co., New Haven, Conn.				
20952	....	Station Agent from factory...	5.05	4.53	32.94
	Manufacturer unknown				
20692	13042................	Conn. Sumatra Tobacco, Buckland...............	4.40	....	.....
21411	....	J. Stuart Halpine, Burnside..	5.16	....	.....

TABLE IV. SUMMARY OF DATA ON COTTONSEED MEAL.

GROUP.	Number of Samples.	Number Deficient.	Average Nitrogen %	Average Cost per Ton.	Average Cost of Nitrogen, cents per Pound.
36 per cent (5.76 N)	16	2	5.84	$52.46[1]	44.9
41 per cent (6.56 N)	125	32	6.58	44.33[2]	33.7
43 per cent (6.88 N)	23	4	6.83	56.73[3]	41.5
Odd per cent	3	0	...	....	...
No guaranty	12	..	...	....	...
Totals and averages	179	38	6.53	$51.88[4]	39.7

During the past year the 41 per cent protein meal has been the one chiefly sold and nitrogen has been purchased at the best advantage in this grade. Again it will be noted that nitrogen has cost most in the lowest grade product. The average nitrogen content of all the samples examined is close to the guaranty for the medium grade.

[1] Based on 15 quotations.
[2] Based on 89 quotations.
[3] Based on 21 quotations.
[4] Based on 128 quotations.

TABLE V. ANALYSES OF COTTONSEED MEAL.

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed.	Cost per ton.
	American Cotton Oil Co., Atlanta, Ga.				
20871	Aco. 202054	Hatheway & Steane, Hartford	6.85	6.59	.....
20872	Aco. 31401	Hatheway & Steane, Hartford	6.53	6.59	.....
20873	Aco. 30394	Hatheway & Steane, Hartford	7.08	6.59	.....
20875	Aco. 35614	Hatheway & Steane, Hartford	6.84	6.59	.....
20970	Aco. 54850	Hatheway & Steane, Hartford	6.78	6.59	$55.75
20887	Longhorn, 150715	Clark Bros., Windsor	7.04	6.88	.....
20888	Longhorn, 508164	Clark Bros., Windsor	7.03	6.88	.....
20467	Surety P. A. 22747	The Coles Co., Middletown	5.98	5.75	60.00
20513	Surety. P. R. R. 52412.	The Coles Co., Middletown	5.80	5.75	60.00
21519	Surety. N. C. & St. L., 3166	The Coles Co., Middletown	5.81	5.75	50.00
	Ashcraft-Wilkinson Co., Atlanta, Ga.				
20573	Paramount. N. Y. C., 217460	The Coles Co., Middletown	6.00	5.76	60.00
21405	Paramount. 4577	Geo. S. Phelps & Co., Thompsonville	5.70	5.76	48.15
21406	Paramount. 90630	Geo. S. Phelps & Co., Thompsonville	5.81	5.76	48.15
21407	Paramount. 97602	Geo. S. Phelps & Co., Thompsonville	5.90	5.76	48.15
21502	Paramount	Station Agent from Geo. S. Phelps & Co., Thompsonville	6.03	5.76	52.00
	F. W. Brodé Corp. Memphis, Tenn.				
21509	Owl Brand 36 per cent.	Station Agent from Bristol Grain & Supply Co., Bristol	5.42	5.75	55.00
21516	Owl Brand 43 per cent.	Station Agent from C. M. Beeman, Granby	6.84	6.70	60.90
	Buckeye Cotton Oil Co., Cincinnati, Ohio.				
21510	Buckeye Good C. S. Meal	Station Agent from G. S. Phelps & Co., Thompsonville	5.69	5.76	52.00
	Eastern Cotton Oil Co., Elizabeth City, N. C.				
21215	Ideal	L. Wetstone, Hartford	6.35	6.88	57.00

TABLE V. ANALYSES OF COTTONSEED MEAL—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen: Found.	Per cent Nitrogen: Guaranteed.	Cost per ton.
	Humphreys-Godwin Co., Memphis, Tenn.				
20527	Bee. 31758	American Sumatra Tobacco Co., Bloomfield	6.76	6.58	
20531	Bee. 42022	American Sumatra Tobacco Co., Bloomfield	6.56	6.58	
20532	Bee. 32442	American Sumatra Tobacco Co., Bloomfield	6.65	6.58	
20533	Bee. 304470	American Sumatra Tobacco Co., Bloomfield	7.16	6.58	....
20552	Bee. 173150	American Sumatra Tobacco Co., Bloomfield	6.95	6.58	....
20556	Bee. 76518	American Sumatra Tobacco Co., Bloomfield	6.58	6.58	....
20563	Bee. 31758	American Sumatra Tobacco Co., Bloomfield	6.82	6.58	....
20592	Bee. 11031	American Sumatra Tobacco Co., Bloomfield	6.60	6.58	....
20641	Bee. 34277	American Sumatra Tobacco Co., Bloomfield	6.84	6.58	....
20839	Bull. C.B.&J. 134035	Spencer Bros., Inc., Suffield	7.00	6.87	$59.00
20840	Bull. M. P. 27424	Spencer Bros., Inc., Suffield	6.95	6.87	59.00
20898	Bull. N.& W. 120204	Spencer Bros., Inc., Suffield	6.92	6.87	57.00
21005	Bull	Harold M. Newberry, East Windsor Hill	6.89	6.87	56.50
21053	Bull. N. Y. C. 252455	Spencer Bros., Inc., Suffield	6.83	6.87	59.00
21057	Bull	Harold M. Newberry, East Windsor Hill	6.38	6.87	56.50
21072	Bull. M. C. 94575	Henry Adams & Son, Suffield	7.15	6.87	57.00
21513	Bull	Station Agent from Geo. T. Soule, New Milford	7.00	6.87	60.00
21508	Danish	Station Agent from A. E. Hall, Wallingford	6.32	5.75	50.00
20528	Dixie, 39334	American Sumatra Tobacco Co., Bloomfield	6.84	6.56	....
20529	Dixie, 120253	American Sumatra Tobacco Co., Bloomfield	6.46	6.56	....
20530	Dixie, 40082	American Sumatra Tobacco Co., Bloomfield	5.96	6.56	....
20551	Dixie, 48634	American Sumatra Tobacco Co., Bloomfield	6.44	6.56	....
20553	Dixie, 34042	American Sumatra Tobacco Co., Bloomfield	6.65	6.56	....
20554	Dixie, 174396	American Sumatra Tobacco Co., Bloomfield	6.28	6.56	....
20555	Dixie, 302401	American Sumatra Tobacco Co., Bloomfield	6.59	6.56	....
20557	Dixie, 1574	American Sumatra Tobacco Co., Bloomfield	6.28	6.56	....

TABLE V. ANALYSES OF COTTONSEED MEAL—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed.	Cost per ton.
	Humphreys-Godwin Co., Memphis, Tenn.				
20558	Dixie, 2673	American Sumatra Tobacco Co., Bloomfield	6.58	6.56	....
20559	Dixie, 20228	American Sumatra Tobacco Co., Bloomfield	6.67	6.56	....
20560	Dixie, 866	American Sumatra Tobacco Co., Bloomfield	6.29	6.56	....
20561	Dixie, 85231	American Sumatra Tobacco Co., Bloomfield	6.53	6.56	....
20562	Dixie, 26101	American Sumatra Tobacco Co., Bloomfield	6.14	6.56	....
20576	Dixie, 19903	American Sumatra Tobacco Co., Bloomfield	6.62	6.56	....
20579	Dixie, 21873	American Sumatra Tobacco Co., Bloomfield	6.56	6.56	....
20580	Dixie, 12006	American Sumatra Tobacco Co., Bloomfield	6.84	6.56	....
20582	Dixie, 28527	American Sumatra Tobacco Co., Bloomfield	6.50	6.56	....
20585	Dixie, 29824	American Sumatra Tobacco Co., Bloomfield	6.59	6.56	....
20586	Dixie, 563728	American Sumatra Tobacco Co., Bloomfield	6.80	6.56	....
20588	Dixie, 256339	American Sumatra Tobacco Co., Bloomfield	6.44	6.56	....
20589	Dixie, 29854	American Sumatra Tobacco Co., Bloomfield	6.58	6.56	....
20590	Dixie, 205778	American Sumatra Tobacco Co., Bloomfield	6.26	6.56	....
20591	Dixie, 13800	American Sumatra Tobacco Co., Bloomfield	6.52	6.56	....
20613	Dixie, 174396	American Sumatra Tobacco Co., Bloomfield	6.15	6.56	....
20614	Dixie, 26101	American Sumatra Tobacco Co., Bloomfield	6.71	6.56	....
20615	Dixie, 48634	American Sumatra Tobacco Co., Bloomfield	6.54	6.56	....
20616	Dixie, 4965	American Sumatra Tobacco Co., Bloomfield	6.50	6.56	....
21617	Dixie, 1574	American Sumatra Tobacco Co., Bloomfield	6.15	6.56	....
20618	Dixie, 866	American Sumatra Tobacco Co., Bloomfield	6.30	6.56	....
20619	Dixie, 154534	American Sumatra Tobacco Co., Bloomfield	6.78	6.56	....
20620	Dixie, 40082	American Sumatra Tobacco Co., Bloomfield	6.53	6.56	....

TABLE V. ANALYSES OF COTTONSEED MEAL—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed.	Cost per ton.
	Humphreys-Godwin Co., Memphis, Tenn.				
20621	Dixie, 64985	American Sumatra Tobacco Co., Bloomfield	6.43	6.56	.....
20622	Dixie, 67498	American Sumatra Tobacco Co., Bloomfield	6.50	6.56	.....
20635	Dixie, 112102	American Sumatra Tobacco Co., Bloomfield	6.65	6.56	.....
20636	Dixie, 793	American Sumatra Tobacco Co., Bloomfield	6.92	6.56	.....
20637	Dixie, 56540	American Sumatra Tobacco Co., Bloomfield	6.57	6.56	.....
20638	Dixie, 23626	American Sumatra Tobacco Co., Bloomfield	6.31	6.56	.....
20639	Dixie, 20158	American Sumatra Tobacco Co., Bloomfield	6.72	6.56	.....
20640	Dixie, 28103	American Sumatra Tobacco Co., Bloomfield	7.11	6.56	.....
20642	Dixie, 27910	American Sumatra Tobacco Co., Bloomfield	6.70	6.56	.....
20643	Dixie, 88310	American Sumatra Tobacco Co., Bloomfield	6.68	6.56	.....
20644	Dixie, 47781	American Sumatra Tobacco Co., Bloomfield	6.77	6.56	.....
20645	Dixie, 17844	American Sumatra Tobacco Co., Bloomfield	6.76	6.56	.....
20651	Dixie, 39499	American Sumatra Tobacco Co., Bloomfield	6.73	6.56	.....
20652	Dixie, 42810	American Sumatra Tobacco Co., Bloomfield	6.68	6.56	.....
20653	Dixie, 3873	American Sumatra Tobacco Co., Bloomfield	6.78	6.56	.....
20654	Dixie, 95922	American Sumatra Tobacco Co., Bloomfield	6.78	6.56	.....
20655	Dixie, 110197	American Sumatra Tobacco Co., Bloomfield	6.67	6.56	.....
20656	Dixie, 205778	American Sumatra Tobacco Co., Bloomfield	6.56	6.56	.....
20657	Dixie, 256339	American Sumatra Tobacco Co., Bloomfield	6.40	6.56	.....
20672	Dixie, 248050	American Sumatra Tobacco Co., Bloomfield	6.72	6.56	.....
20673	Dixie, 21436	American Sumatra Tobacco Co., Bloomfield	6.62	6.56	.....
20674	Dixie, 27643	American Sumatra Tobacco Co., Bloomfield	6.74	6.56	.....
20675	Dixie, 43404	American Sumatra Tobacco Co., Bloomfield	6.50	6.56	.....

TABLE V. ANALYSES OF COTTONSEED MEAL—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed	
	Humphreys-Godwin Co., Memphis, Tenn.				
20676	Dixie, 81041	American Sumatra Tobacco Co., Bloomfield	6.59	6.56	..
20677	Dixie, 203924	American Sumatra Tobacco Co., Bloomfield	6.54	6.56	..
20678	Dixie, 220940	American Sumatra Tobacco Co., Bloomfield	7.11	6.56	..
20717	Dixie, 238672	American Sumatra Tobacco Co., Bloomfield	6.54	6.56	..
20718	Dixie, 302630	American Sumatra Tobacco Co., Bloomfield	6.56	6.56	..
20719	Dixie, 99325	American Sumatra Tobacco Co., Bloomfield	6.38	6.56	..
20720	Dixie, 18300	American Sumatra Tobacco Co., Bloomfield	6.60	6.56	..
20721	Dixie, 104508	American Sumatra Tobacco Co., Bloomfield	6.58	6.56	..
20722	Dixie, 121633	American Sumatra Tobacco Co., Bloomfield	6.36	6.56	..
20723	Dixie, 238316	American Sumatra Tobacco Co., Bloomfield	6.31	6.56	..
20724	Dixie, 305782	American Sumatra Tobacco Co., Bloomfield	6.62	6.56	..
20725	Dixie, 2813	American Sumatra Tobacco Co., Bloomfield	6.54	6.56	..
20726	Dixie, 423777	American Sumatra Tobacco Co., Bloomfield	6.29	6.56	..
20727	Dixie, 242674	American Sumatra Tobacco Co., Bloomfield	6.87	6.56	..
20728	Dixie, 40103	American Sumatra Tobacco Co., Bloomfield	6.70	6.56	..
20729	Dixie, 24458	American Sumatra Tobacco Co., Bloomfield	6.59	6.56	..
20730	Dixie, 15534	American Sumatra Tobacco Co., Bloomfield	6.41	6.56	..
20731	Dixie, 229698	American Sumatra Tobacco Co., Bloomfield	6.27	6.56	..
20732	Dixie, 122719	American Sumatra Tobacco Co., Bloomfield	6.74	6.56	..
20733	Dixie, 50369	American Sumatra Tobacco Co., Bloomfield	6.57	6.56	..
20757	Dixie, 55296	American Sumatra Tobacco Co., Bloomfield	6.37	6.56	..
20777	Dixie, 21239	American Sumatra Tobacco Co., Bloomfield	6.52	6.56	..
20778	Dixie, 236413	American Sumatra Tobacco Co., Bloomfield	6.52	6.56	..

TABLE V. ANALYSES OF COTTONSEED MEAL—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed.	Cost per ton.
	Humphreys-Godwin Co., Memphis, Tenn.				
20779	Dixie, 20650..........	American Sumatra Tobacco Co., Bloomfield..........	6.50	6.56	...
20780	Dixie, 191653.........	American Sumatra Tobacco Co., Bloomfield..........	6.56	6.56	...
20781	Dixie, 35903..........	American Sumatra Tobacco Co., Bloomfield..........	6.57	6.56	...
20782	Dixie, 107284..........	American Sumatra Tobacco Co., Bloomfield..........	6.38	6.56	..
20783	Dixie, 21049..........	American Sumatra Tobacco Co., Bloomfield..........	6.61	6.56	...
20794	Dixie, 25137..........	American Sumatra Tobacco Co., Bloomfield..........	6.59	6.56	...
20795	Dixie, 73426..........	American Sumatra Tobacco Co., Bloomfield..........	6.68	6.56	...
20796	Dixie, 3027...........	American Sumatra Tobacco Co., Bloomfield..........	6.68	6.56	...
20797	Dixie, 45769..........	American Sumatra Tobacco Co., Bloomfield..........	6.67	6.56	...
20798	Dixie, 21710..........	American Sumatra Tobacco Co., Bloomfield..........	6.66	6.56	...
20799	Dixie, 194528.........	American Sumatra Tobacco Co., Bloomfield,.........	6.62	6.56	..
20800	Dixie, 70649..........	American Sumatra Tobacco Co., Bloomfield..........	6.57	6.56	...
20844	Dixie, 103931.........	Hatheway & Steane, Hartford	6.78	6.56	...
20847	Dixie, 140952..........	Hatheway & Steane, Hartford	6.42	6.56	$55.
20848	Dixie, 38058..........	Hatheway & Steane, Hartford	6.38	6.56	55.
20850	Dixie, 17640..........	Hatheway & Steane, Hartford	6.59	6.56	...
20870	Dixie, 5622...........	Hatheway & Steane, Hartford	6.55	6.56	...
20874	Dixie, 112821.........	Hatheway & Steane, Hartford	6.71	6.56	...
20931	Dixie, 223492.........	American Sumatra Tobacco Co., Bloomfield..........	6.37	6.56	...
20932	Dixie, 13384..........	American Sumatra Tobacco Co., Bloomfield..........	6.30	6.56	...
20933	Dixie, 11031..........	American Sumatra Tobacco Co., Bloomfield..........	6.58	6.56	...
20969	Dixie, 1549...........	Hatheway & Steane, Hartford	6.71	6.56	55.
21062	Dixie.................	Station Agent from J. P. Norton, Broad Brook........	6.60	6.56	54.
21533	Dixie.................	Station Agent from Fassler & Silberman, Hartford......	6.50	6.56	...
21534	Dixie.................	Station Agent from Fassler & Silberman, Hartford......	6.64	6.56	...
21535	Dixie.................	Station Agent from Fassler & Silberman, Hartford......	6.14	6.56	...

TABLE V. ANALYSES OF COTTONSEED MEAL—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed.	Cost per ton.
	Humphreys-Godwin Co., Memphis, Tenn.				
21536	Dixie	Station Agent from Fassler & Silberman, Hartford	6.61	6.56	....
21538	Dixie	Station Agent from Fassler & Silberman, Hartford	6.42	6.56	....
20587	Owl. 41, 110197	American Sumatra Tobacco Co., Bloomfield	6.31	6.56	....
20577	111894	American Sumatra Tobacco Co., Bloomfield	6.76	....	....
20578	90546	American Sumatra Tobacco Co., Bloomfield	6.14	....	....
20581	194870	American Sumatra Tobacco Co., Bloomfield	6.44	6.56	....
20583	35004	American Sumatra Tobacco Co., Bloomfield	6.58	6.56	....
20584	36735	American Sumatra Tobacco Co., Bloomfield	6.30	6.56	....
20885	28201	American Sumatra Tobacco Co., Bloomfield	6.15	6.56	....
20886	109077	American Sumatra Tobacco Co., Bloomfield	6.36	6.56	....
	L. B. Lovitt & Co., Memphis, Tenn.				
21066	Thirty-six	Station Agent from W. C. Child, Woodstock	5.80	5.75	$41.50
21512	Neal's Choice	Station Agent from Willimantic Grain Co., Willimantic	7.04	6.88	60.00
	Lyle & Lyle, Huntsville, Alabama.				
20090	Economy, P. R. R., 83450	The Coles Company, Middletown	5.77	5.76	53.00
	Marianna Cotton Oil Co., Marianna, Ark.				
21107	White Mule, 41%	Station Agent from C. M. Beeman, Granby	6.59	6.58	57.00
21514	White Mule, 43%	Station Agent from Geo. E. Ackley Co., New Milford	7.00	6.88	60.00
21517	White Mule, 41%	Station Agent from E. H. Rollins, Granby	6.57	6.58	57.00
21715	White Mule Brand	P. Schwartz Co., New London	5.85	5.75	53.00

TABLE V. ANALYSES OF COTTONSEED MEAL—*Concluded.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed.	
	W. C. Nothern, Memphis, Tenn.				
20631	Bee. S. P. 69010	E. N. Austin, Suffield	6.23	6.88	$58
20743	Bee	Station Agent from E. N. Austin, Suffield	6.63	6.88	58
	Olds & Whipple, Hartford.				
20834	41903	L. B. Haas & Co., Hartford	6.77	6.88	45
20835	41903	L. B. Haas & Co., Hartford	6.99	6.88	45
20836	16261	L. B. Haas & Co., Hartford	7.02	6.99	58
20837	80685	L. B. Haas & Co., Hartford	6.95	6.99	58
20845	35645	Hatheway & Steane, Hartford	6.70	6.56	..
20846	130210	Hatheway & Steane, Hartford	6.67	6.56	..
20849	16035	Hatheway & Steane, Hartford	6.56	6.56	..
	Pheonix Cotton Oil Co., Memphis, Tenn.				
21052	Phoenix, C. M. & St. P. 701595	Spencer Bros., Inc., Suffield	6.86	6.87	58
21216	Phoenix, S. F. 130089	L. Wetstone, Hartford	6.62	6.87	57
21217	Phoenix, N. Y. C. 230924	L. Wetstone, Hartford	6.91	6.87	57
21218	Phoenix. Erie 110189	L. Wetstone, Hartford	6.83	6.87	57
21314	Phoenix	E. N. Austin, Suffield	6.83	6.87	55
21551	Phoenix	Station Agent from E. N. Austin, Suffield	6.74	6.87	60
	The Rogers & Hubbard Co., Portland.				
21507		Station Agent from Factory.	6.03	5.75	..
	A. C. Westervelt & Co., Memphis, Tenn.				
21518	Sun	Station Agent from Geo. W. Case, New Hartford	5.58	5.75	56
	Manufacturer Unknown				
20690	104578	Conn. Sumatra Tobacco Co., Buckland	6.99	....	..
20691	10064	Conn. Sumatra Tobacco Co., Buckland	6.52	....	..
20707	16345	Conn. Sumatra Tobacco Co., Buckland	6.75	....	..
20708	28887	Conn. Sumatra Tobacco Co., Buckland	6.73	....	..
19962	41961 A. C. L.	The Coles Company, Middletown	5.77	....	..

LINSEED MEAL.

Three samples, all purchased from Olds & Whipple, Inc., Hartford, were submitted by Hatheway & Steane, Hartford.

The samples were **20880**, **20967** and **20968** and were found to contain 5.20, 5.27 and 5.16 per cent. of nitrogen respectively. *The selling price was $54.50 per ton, at which price nitrogen cost about 52 cents per pound. This estimate, however, is based upon very limited data; probably the use of linseed meal in fertilizers has not been extensive.*

II. RAW MATERIALS CHIEFLY VALUABLE FOR PHOSPHORIC ACID.

RAW ROCK PHOSPHATE.

One sample was analyzed as follows:

21531. Mitchell's Phosphoflour. Sold by W. L. Mitchell, New Haven. Stock of J. W. Alsop, Avon.

Analysis:

Station No.	21531
Total phosphoric acid:	
found	29.60%
guaranteed	28.00

PRECIPITATED BONE PHOSPHATE.

Sixteen samples of precipitated bone were analyzed and analyses are given in Table VI.

So-called precipitated bone phosphate is a by-product in the manufacture of gelatin. Bones are treated with acid to extract mineral substances and when this acid solution is treated with milk of lime the phosphorus is precipitated largely or entirely as di-calcium phosphate, which is the precipitated bone phosphate of commerce. Phosphoric acid in this material is practically all "available."

The samples examined this year have equaled or exceeded their guaranties in all cases and the cost of "available" phosphoric acid at the average of prices quoted ($54.65), has been 6.9 cents per pound.

TABLE VI. ANALYSES OF PRECIPITATED BONE PHOSPHATE.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. "Available." Found.	Phosphoric Acid. "Available." Guaranteed.	Cost per ton or per unit of phosphoric acid.
	Sampled by Station:		%	%	%	%	
21067	American Agricultural Chemical Co., New York City..........	J. P. Norton, Broad Brook..............	0.10	36.60	36.50	36.00	$52.25
21042	Apothecaries Hall Co., Waterbury	Sampled at Factory, East Windsor.......	0.60	40.70	40.10	36.00	50.00
20943	Olds & Whipple, Inc., Hartford...	Sampled at Factory.....................	0.90	39.00	38.10	38.00	54.15
	Sampled by Purchaser:						
20758	American Glue Co., Boston, Mass.	American Sumatra Tobacco Co., Bloomfield	1.21	40.76	39.55	.....	.....
20453	H. Fasting, New York..........	American Sumatra Tobacco Co., Bloomfield	0.05	38.94	38.89	38.00	.....
20454	H. Fasting, New York..........	American Sumatra Tobacco Co., Bloomfield	0.07	38.94	38.87	38.00	.....
20455	H. Fasting, New York..........	American Sumatra Tobacco Co., Bloomfield	0.10	38.96	38.86	38.00	.....
20456	H. Fasting, New York..........	American Sumatra Tobacco Co., Bloomfield	0.04	38.96	38.92	38.00	.....
20457	H. Fasting, New York..........	American Sumatra Tobacco Co., Bloomfield	0.03	39.04	39.01	38.00	.....
20458	H. Fasting, New York..........	American Sumatra Tobacco Co., Bloomfield	none	39.32	39.32	38.00	.....
20602	H. Fasting, New York..........	American Sumatra Tobacco Co., Bloomfield	0.46	41.80	41.34	.....	.....
20977	Olds & Whipple, Hartford.......	Hatheway & Steane, Hartford...........	0.45	38.50	38.05	38.00	52.31
21008	Olds & Whipple, Inc., Hartford...	Harold M. Newberry, East Windsor Hill..	1.10	40.15	39.05	38.00	57.00
21060	Olds & Whipple, Inc., Hartford...	Harold M. Newberry, East Windsor Hill..	3.60	45.25	41.65	38.00	56 50
21246	Olds & Whipple, Inc., Hartford...	Harold M. Newberry, East Windsor Hill..	1.95	42.20	40.25	38.00	1.50
20710	....	Conn. Sumatra Tobacco Co., Buckland...	0.40	41.88	41.48	.....	.....

DISSOLVED ROCK PHOSPHATE OR ACID PHOSPHATE.

Twenty-one samples were examined and analyses are given in Table VII.

This material is made by treating rock phosphate with sulphuric acid which results in a conversion of the phosphorus largely into "available" form. In acid phosphates most of the available phosphoric acid is soluble in water.

This commercial product is generally guaranteed to contain 16 per cent. of phosphoric acid in "available" forms, i. e., soluble in water and soluble in ammonium citrate solution. All of the samples examined during the past season substantially met or exceeded their guaranties except **21287** which was deficient by 0.48 per cent. No. **21257** contained the guaranteed amount of available phosphoric acid (10 per cent.), but a considerable proportion of the total was in insoluble form.

The prices quoted for "acid phosphate" ranged from $16.00 to $30.00, the average being $23.45. At these prices the cost per pound of "available" phosphoric acid has been from 4.9 to 9.5 cents, the average being 7.2 cents.

TABLE VII. ANALYSES OF ACID PHOSPHATE.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	"Available" Found.	"Available" Guaranteed.	Cost per ton.	"Available" phosphoric acid costs cents per pound.	Station No.
	Sampled by Station:		%	%	%	%			
20988	American Agricultural Chemical Co., New York	J. H. Paddock, Wallingford	0.83	17.33	16.50	16	$28.00	8.5	20988
20909	Apothecaries Hall Co., Waterbury	Sampled at Factory	0.60	17.03	16.43	16	25.00	7.6	20909
21044	Armour Fertilizer Works, New York	Rockville Grain & Coal Co., Rockville	0.54	16.39	15.85	16	30.00	9.5	21044
21324	Armour Fertilizer Works, New York	A. E. Shedd, Norwich	0.59	16.61	16.02	16	16.50	5.1	21324
20928	Berkshire Fertilizer Co., Bridgeport	Sampled at Factory	0.53	17.60	17.07	16	24.70	7.2	20928
21180	Bowker Fertilizer Co., New York	C. A. Templeton, Inc., Waterbury	0.93	17.28	16.35	16	25.00	7.6	21180
21287	E. D. Chittenden Co., Bridgeport	J. E. Stoddard, Abington	0.61	16.13	15.52	16	26.00	8.4	21287
21296	E. B. Clark Seed Co., Milford	Geo. R. Russell, Branford	0.20	16.85	16.65	16	19.50	5.9	21296
21201	Coe-Mortimer Co., New York	Morrison & Dunham, Bethel	1.05	17.13	16.08	16	29.00	9.0	21201
20920	Consolidated Rendering Co., Boston, Mass	Sampled at Factory, New Haven	0.08	17.68	17.60	16	.....	...	20920
21292	Eastern States Farmers' Exchange, Springfield, Mass	G. R. Stannard, Branford	0.18	16.73	15.95	16	26.50	8.3	21292
21257	W. L. Mitchell, New Haven	A. E. Shedd, Norwich	11.35	23.45	12.10	10	18.25	7.5	21257
21532	W. L. Mitchell, New Haven	Hanson Bros., New Haven	1.20	17.50	16.30	16	19.00	5.8	21532
21396	Nitrate Agencies Co., New York	W. E. Coe, Stamford	1.35	17.40	16.05	16	.....	...	21396
20944	Olds & Whipple, Inc., Hartford	Sampled at Factory	0.45	16.55	16.10	16	21.85	6.8	20944

TABLE VII. ANALYSES OF ACID PHOSPHATE—*Concluded.*

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Phosphoric Acid.				Cost per ton.	"Available" phosphoric acid costs cents per pound.	Station No.
			Citrate-insoluble.	Total.	"Available" Found.	"Available" Guaranteed.			
			%	%	%	%			
20939	The Rogers & Hubbard Co., Portland	Sampled at Factory	0.10	17.53	17.43	16	$23.50	6.7	20939
21478	F. S. Royster Guano Co., Baltimore, Md	A. D. Bridges' Sons, Inc., Hazardville	1.20	17.25	16.05	16	28.00	8.7	21478
20950	Sanderson Fertilizer & Chemical Co., New Haven	Sampled at Factory	0.78	17.68	16.90	16	21.91	6.5	20950
21493	Virginia-Carolina Chemical Co., New York	F. A. Beckwith, Niantic	1.08	18.03	16.95	16	.....	...	21493
21118	Wilcox Fertilizer Co., Mystic	Sampled at Factory	0.18	17.50	17.32	17	.....	...	21118
	Sampled by Purchaser:								
21157	L. T. Frisbie Co., New Haven	The A. E. Plant Sons Co., Branford	0.13	16.38	16.25	16	16.00	4.9	21157

III. RAW MATERIALS CONTAINING POTASH AS THE CHIEF ACTIVE INGREDIENT.

Analyses of these materials are given in Tables VIII and IX.

CARBONATE OF POTASH.

Four samples, all drawn by the purchasers, were examined.

This material is generally from 88 to 95 per cent pure and contains from 60 to 65 per cent of actual potash (K_2O). Of the samples examined this year two were somewhat below average quality. No prices were quoted to us for this source of potash.

MURIATE OF POTASH.

Eight samples were analyzed all but one of which were drawn by the Station agent.

This is the potash salt which is chiefly imported for agricultural purposes and is about 80 per cent pure, equivalent to 50.5 per cent of actual potash (K_2O). Because it readily absorbs moisture it is frequently guaranteed 48 per cent potash.

All the samples examined exceeded their guaranties except **21301** which was somewhat deficient. *So far as prices are known the cost per pound of actual potash ranged from 4 to 6.2 cents, the average being 5.0 cents.*

HIGH GRADE SULPHATE OF POTASH.

Thirteen samples were examined: one, however, **20751**, was merely tested qualitatively to determine whether or not it was a sulphate.

The commonest grade of this potash salt is the one containing about 48 per cent of actual potash or about 90 per cent sulphate of potash. Nos. **21722** and **21009** were the only samples which failed to satisfy their guaranties.

No. **21253** contained less than 48 per cent but no statement of guaranty was given. This sample contained a little ammonia, probably in the form of ammonium sulphate. At the price given us, potash in this lot cost 7.9 cents per pound, which is the extreme figure found this year. *Excluding this sample, the cost per pound of potash from this source has ranged from 3.9 to 6.1 cents and averaged 5.3 cents.*

KAINIT.

Only one sample was analyzed. *It fully met its guaranty and at the price quoted ($20.00), potash cost the purchaser 8 cents per pound.*

The potash in kainit is combined largely or entirely with chlorine and a considerable amount of common salt (sodium chloride) is also present. For this reason the use of kainit is avoided in mixed fertilizers intended for tobacco in this State where wrapper leaf is largely grown.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Cost per ton.	Potash costs cents per pound.	Station No.
	Carbonate of Potash. *Sampled by Purchaser:*		%	%			
20966	Olds & Whipple, Inc., Hartford..	Hatheway & Steane, Hartford..........	63.92	.....	.....	.....	20966
20759	Suberfos Co., New York City...	American Sumatra Tobacco Co., Bloomfield	64.44	.....	.....	.....	20759
20734	86861......................	American Sumatra Tobacco Co., Bloomfield	56.68	.....	.....	.....	20734
20760	6469.......................	American Sumatra Tobacco Co., Bloomfield	57.92	.....	.....	.....	20760
	Muriate of Potash. *Sampled by Station:*						
21269	American Agricultural Chemical Co., New York............	W. B. Martin, Rockville...............	49.73	48.00	$54.00	5.4	21269
21040	Apothecaries Hall Co., Waterbury	Sampled at Factory....................	52.26	50.00	65.00	6.2	21040
21168	Armour Fertilizer Co., New York City.....................	John O. Fox, Putnam..................	48.50	48.00	55.00	5.7	21168
21325	Armour Fertilizer Co., New York City.....................	A. E. Shedd, Norwich..................	49.98	48.00	39.50	4.0	21325
20927	Berkshire Fertilizer Co., Bridgeport.....................	Sampled at Factory....................	53.30	50.00	45.00	4.2	20927
20925	Consolidated Rendering Co., Boston, Mass..............	Sampled at Factory, New Haven.........	52.60	50.00	.....	.....	20925
21301	Eastern States Farmers' Exchange, Springfield, Mass.....	Minor Ives, So. Meriden...............	46.06	50.00	.....	.....	21301
	Sampled by Purchaser:						
21160	L. T. Frisbie Co., New Haven...	A. E. Plant Sons Co., Branford..........	51.67	48.00	43.00	4.2	21160

TABLE VIII. ANALYSES OF POTASH SALTS—*Concluded.*

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Cost per ton.	Potash costs cents per pound.	Station No.
	High Grade Sulphate of Potash. *Sampled by Station:*		%	%			
21068	Apothecaries Hall Co., Waterbury	*J. P. Norton, Broad Brook*	48.46	48.00	$53.00	5.5	21068
20946	Olds & Whipple, Inc., Hartford	Sampled at Factory	49.42	48.00	53.00	5.4	20946
20995	American Agricultural Chemical Co., New York	Geo. S. Phelps & Co., Thompsonville	50.05	48.00	60.00	6.0	20995
20953	Apothecaries Hall Co., Waterbury	Sampled at Factory	50.80	48.00	55.00	5.4	20953
20929	Berkshire Fertilizer Co., Bridgeport	Sampled at Factory	50.80	48.00	55.00	5.4	20929
20921	Consolidated Rendering Co., Boston, Mass	Sampled at Factory, New Haven	49.90	48.00	.....	.....	20921
21400	Nitrate Agencies Co., New York City	E. N. Austin, Suffield	49.12	48.00	60.00	6.1	21400
21722	Rogers & Hubbard Co., Portland	Sampled at Factory	44.58	48.00	.....	.....	21722
	Sampled by Purchaser:						
20742	Apothecaries Hall Co., Waterbury	J. E. Shepard, So. Windsor	48.88	48.00	48.00	4.9	20742
21009	Olds & Whipple, Inc., Hartford	Harold M. Newberry, East Windsor Hill	45.80	48.00	36.10	3.9	21009
21247	Olds & Whipple, Inc., Hartford	Harold M. Newberry, East Windsor Hill	50.50	48.00	53.20	5.3	21247
21253	....	Walter Clark, Norwich, Conn	46.64	.....	74.00	7.9	21253
	Kainit. *Sampled by Station:*						
21539	Consumers Chemical Corp., New York City	E. C. Chapman, North Haven	12.57	12.40	20.00	8.0	21539

TABLE IX. ANALYSES OF DOUBLE MANURE SALTS.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Magnesia.	Chlorine.	Cost per ton.	Potash costs cents per pound.	Station No.
	Sampled by Station:		%	%	%	%			
21271	American Agricultural Co., New York	W. H. Carrier, Glastonbury	26.21	25.00	9.00	2.28	$42.00	8.0	21271
20930	Berkshire Fertilizer Co., Bridgeport	Sampled at Factory	26.84	26.00	9.99	2.33	....	....	20930
20947	Olds & Whipple, Inc., Hartford	Sampled at Factory	27.50	26.00	9.49	2.08	32.00	5.8	20947
	Sampled by Purchaser:								
20851	Olds & Whipple, Inc., Hartford	Hatheway & Steane, Hartford	24.24	26.00	9.60	4.32	....	....	20851
20852	Olds & Whipple, Inc., Hartford	Hatheway & Steane, Hartford	36.22	26.00	6.08	4.83	....	....	20852
20868	Olds & Whipple, Inc., Hartford	J. E. Shepard, South Windsor	30.26	26.00	11.66	2.84	28.82	4.8	20868
20877	Olds & Whipple, Inc., Hartford	Hatheway & Steane, Hartford	27.14	26.00	12.44	1.31	....	....	20877
20878	Olds & Whipple, Inc., Hartford	Hatheway & Steane, Hartford	26.84	26.00	8.46	4.10	....	....	20878
20879	Olds & Whipple, Inc., Hartford	Hatheway & Steane, Hartford	39.88	26.00	4.65	3.36	....	....	20879
20978	Olds & Whipple, Inc., Hartford	Hatheway & Steane, Hartford	34.86	26.00	5.19	3.01	....	....	20978
21061	Olds & Whipple, Inc., Hartford	Harold M. Newberry, East Windsor Hill	25.71	26.00	13.50	1.87	36.10	7.00	21061

DOUBLE SULPHATE OF POTASH AND MAGNESIA OR "DOUBLE MANURE SALTS."

Eleven samples were analyzed. Three were sampled by the Station agent and eight were submitted by the purchasers.

This salt was a familiar source of potash before the war. A few samples were found among our dealers in 1922 and a larger number were collected this year. Potash from this source is favored by tobacco growers not only because it is relatively free from chlorine but because it also carries a considerable amount of magnesium.

Last year a product called "Manure Salts" appeared on the market which was mistaken by some purchasers for the "Double Sulphate" or "Double Manure Salts." It was found that the "Manure Salts" was quite a different article; it contained much chlorine and little magnesia. No samples of the product were found during the past season.

Potash in the double sulphate is generally guaranteed at 26 per cent and the samples examined have exceeded that figure except in two cases *viz.*, **20851** and **21061**, where deficiencies of 1.76 and 0.29 per cent respectively were found. Samples **20852**, **20879**, **20978** and probably also **20868** contained high percentages of potash due to accidental mixture with high grade sulphate.

Prices are not available in all cases but, excluding **20868** *for the reason just given, the range has been from 5.8 to 8.0 cents per pound for actual potash. The average, excluding the four abnormally high samples, based upon the average of three prices is 7 cents per pound.*

IV. RAW MATERIALS CONTAINING NITROGEN AND POTASH.

Two samples of "Nitrapo", Nos. **20648** and **21401**, both purchased from the Nitrates Agencies Co., New York, by E. N. Austin, Suffield, were analyzed. One of the samples was drawn by the Station agent and the other was submitted by the purchaser.

Two samples called Nitrate of Potash were examined but they were not pure nitrate of potash, but "Nitrapo" or material of the same type. One of these, **20954**, was sampled by the Station agent from the stock of Apothecaries Hall Co., Waterbury. The other, **20610**, was submitted by H. M. Rogers, Southington.

Analyses are as follows:

TABLE X. ANALYSES OF "NITRAPO".

Station No.	**20648**	**21401**	**20954**	**20610**
	%	%	%	%
Nitrogen:				
found	14.88	14.84	14.80	15.28
guaranteed	14.80	14.80	15.00	.....
Potash:				
found	15.67	15.01	14.07	9.49
guaranteed	15.00	15.00	12.00	.....

V. RAW MATERIALS CONTAINING NITROGEN AND PHOSPHORIC ACID.

DRY GROUND FISH.

Forty-nine samples of dry ground fish have been analyzed during the year. Of these seventeen were sampled by the Station agent and thirty-two were submitted by purchasers. Analyses are given in Table XI.

This material is generally guaranteed to contain 8.23 per cent of nitrogen and 5 to 6 per cent of phosphoric acid. In a number of cases guaranties were not furnished, but in none of these were the nitrogen and phosphoric acid found less than the amounts usually guaranteed. Of those samples with guaranties, eight were deficient in nitrogen by amounts exceeding 0.1 per cent. The difficient samples were as follows:

Station No.	Deficiency in Nitrogen
21266	0.21%
21219	0.17
20436	0.84
20437	0.17
20439	0.26
20564	0.22
20565	0.12
20791	0.14

None of the samples were deficient in phosphoric acid.

The price has varied between the rather wide limits of $58.00 and $80.00 only one quotation of the high figure being recorded. The average of prices quoted confidentially or otherwise, is $64.90.

The averages for nitrogen and phosphoric acid are 8.64 and 7.86 per cent respectively which makes the cost per pound of nitrogen 31.5 cents, allowing 6 cents per pound for total phosphoric acid.

Chlorine Content of Dry Ground Fish.

Chlorine was determined in forty-eight of the samples examined this year. Two samples, **20704** and **21402** were found to contain 3.25 per cent and 2.63 per cent chlorine respectively. Excluding these two, the remaining samples may be summarized as follows:

Maximum	0.74%
Minimum	0.14
Average	0.25

The salt content of this product does not appear to be a matter of serious consideration, at least so far as the domestic product is concerned. We understand that fish manures from foreign sources may run higher in this particular, but we have no information as to whether or not the two samples already mentioned which contained excessive amounts of salt were imported products.

TABLE XI. ANALYSES OF

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.
	Sampled by Station:	
21071	American Agricultural Chemical Co., New York	A. E. Potwine, Warehouse Pt....
21266	American Agricultural Chemical Co., New York	J. P. Norton, Broad Brook
20961	Apothecaries Hall Co., Waterbury.	Sampled at factory, East Windsor
20542	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield
20543	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield
20544	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield
20907	Berkshire Fertilizer Co., Bridgeport	Sampled at Factory
21198	E. D. Chittenden Co., Bridgeport.	E. J. Bantle, Glastonbury
20924	L. T. Frisbie Co., New Haven	Sampled at Factory
21402	Nitrate Agencies Co., New York	E. N. Austin, Suffield
20945	Olds & Whipple, Inc., Hartford	Sampled at Factory
21032	Olds & Whipple, Inc., Hartford	J. E. Shepard, South Windsor
21537	Olds & Whipple, Inc., Hartford	Fassler & Silberman, Hartford
20938	Rogers & Hubbard Co., Portland	Sampled at Factory
21470	F. S. Royster Guano Co., Baltimore	O. R. Morgan, Glastonbury
21219	Sanderson Fertilizer & Chemical Co., New Haven	G. A. Frink, Wapping
20958	Wilcox Fertilizer Co., Mystic	Spencer Bros., Inc., Suffield
	Sampled by Purchaser:	
20436	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield
20437	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield
20438	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield
20439	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield
20440	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield
20441	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield
20525	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield
20526	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield
20564	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield
20565	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield

Dry Ground Fish.

Nitrogen.				Phosphoric Acid.				
As ammonia.	As organic.	Total found.	Total guaranteed.	Citrate-insoluble.	Total found.	Total guaranteed.	Cost per ton.	Station No.
%	%	%	%	%	%	%		
0.29	7.97	8.26	8.23	....	8.83	6.00	$78.00	21071
0.10	7.92	8.02	8.23	....	7.88	6.00	75.00	21266
0.49	9.11	9.60	8.20	....	6.40	5.50	80.00	20961
0.20	8.70	8.90	....	....	7.09	....	....	20542
0.24	8.30	8.54	....	....	7.62	....	....	20543
0.19	8.38	8.57	....	....	8.24	....	....	20544
1.62	6.54	8.16	8.23	....	8.80	6.00	65.00	20907
0.19	7.91	8.10	8.12	....	7.50	6.00	71.00	21198
0.26	8.10	8.36	8.22	....	8.43	6.40	....	20924
0.50	8.72	9.22	9.04	....	5.70	5.26	70.00	21402
0.10	9.40	9.50	8.23	2.68	8.20	5.00	71.25	20945
0.20	8.26	8.46	8.23	....	7.40	5.00	60.00	21032
0.18	8.22	8.40	8.23	1.63	6.83	5.00	....	21537
0.28	8.82	9.10	9.00	....	7.73	....	75.00	20938
0.18	8.09	8.27	8.23	1.20	6.28	5.00	....	21470
0.23	7.83	8.06	8.23	....	8.90	6.00	78.00	21219
0.93	8.39	9.32	9.04	0.98	7.38	6.00	70.00	20958
0.25	7.13	7.38	8.22	....	12.54	....	....	20436
0.18	7.87	8.05	8.22	....	8.49	....	....	20437
0.30	8.22	8.52	8.22	....	6.87	....	....	20438
0.20	7.76	7.96	8.22	....	9.79	....	....	20439
0.19	8.37	8.56	8.22	....	7.84	....	....	20440
0.21	8.50	8.71	8.22	....	7.23	....	....	20441
0.24	8.55	8.79	8.22	....	8.42	....	....	20525
0.24	9.00	9.24	8.22	....	6.47	....	....	20526
0.30	7.70	8.00	8.22	....	10.89	....	....	20564
0.26	7.84	8.10	8.22	....	9.95	....	....	20565

TABLE XI. ANALYSES OF

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.
	Sampled by Purchaser:	
20566	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield................
20567	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield.................
20568	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield.................
20600	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield................
20601	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield.................
20761	79054.........................	American Sumatra Tobacco Co., Bloomfield.................
20714	Berkshire Fertilizer Co., Bridgeport	J. E. Shepard, South Windsor...
20791	Berkshire Fertilizer Co., Bridgeport	J. E. Shepard, South Windsor...
21158	L. T. Frisbie Co., New Haven....	A. E. Plant Sons Co., Branford..
20704	Nitrate Agencies Co., New York...	E. N. Austin, Suffield.........
20841	Olds & Whipple, Inc., Hartford...	Hatheway & Steane, Hartford...
20842	Olds & Whipple, Inc., Hartford...	Hatheway & Steane, Hartford...
20843	Olds & Whipple, Inc., Hartford...	Hatheway & Steane, Hartford...
20876	Olds & Whipple, Inc., Hartford...	Hatheway & Steane, Hartford...
20971	Olds & Whipple, Inc., Hartford...	Hatheway & Steane, Hartford...
21007	Olds & Whipple, Inc., Hartford...	Harold M. Newberry, East Windsor Hill..................
21059	Olds & Whipple, Inc., Hartford...	Harold M. Newberry, East Windsor Hill..................
21245	Olds & Whipple, Inc., Hartford....	Harold M. Newberry, East Windsor Hill..................
20693	75301.........................	Conn. Sumatra Tobacco Co., Buckland.................
20694	78899.........................	Conn. Sumatra Tobacco Co., Buckland.................
20709	47472.........................	Conn. Sumatra Tobacco Co., Buckland.................
21579	....	L. T. Frisbie Co., New Haven...

Dry Ground Fish—*Concluded.*

Nitrogen.				Phosphoric Acid.				
As ammonia.	As organic.	Total found.	Total guaranteed.	Citrate-insoluble	Total found.	Total guaranteed.	Cost per ton.	Station No.
%	%	%	%	%	%	%		
0.26	8.50	8.76	8.22	....	8.06	....	....	20566
0.18	9.14	9.32	8.22	....	7.61	....	....	20567
0.16	8.84	9.00	8.22	....	8.01	....	....	20568
0.20	8.06	8.26	....	....	7.52	....	....	20600
0.22	8.81	9.03	....	....	7.71	....	....	20601
0.64	8.94	9.58	....	....	8.21	....	....	20761
0.18	8.12	8.30	....	....	7.82	....	$65.00	20714
0.19	7.89	8.08	8.22	....	7.85	....	65.00	20791
0.22	8.33	8.55	8.22	....	7.55	6.40	58.00	21158
0.47	8.81	9.28	....	....	5.95	....	66.00	20704
0.25	8.42	8.67	8.23	....	7.29	5.00	60.00	20841
0.24	8.16	8.40	8.23	....	7.32	5.00	60.00	20842
0.26	8.28	8.54	8.23	....	6.98	5.00	60.00	20843
0.22	8.48	8.70	8.23	....	7.02	5.00	....	20876
0.18	8.41	8.59	8.23	....	7.93	5.00	60.00	20971
0.20	9.12	9.32	8.24	....	8.25	5.00	74.10	21007
0.16	8.96	9.12	8.23	....	8.23	5.00	74.10	21059
0.17	9.67	9.84	8.23	....	7.23	5.00	72.20	21245
0.26	8.42	8.68	....	....	7.62	....	....	20693
0.22	8.55	8.77	....	....	7.27	....	....	20694
0.28	8.12	8.40	....	....	7.36	....	....	20709
....	....	8.22	8.22	....	8.68	6.40	60.00	21579

Table XII. Analyses of Tankage.

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen.				Phosphoric Acid.		Mechanical Analysis.		Cost per ton.	Station No.
			As ammonia.	As organic.	Total found.	Total guaranteed.	Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.		
	Bone and Meat Tankage *Sampled by Station.*		%	%	%	%	%	%	%	%		
21162	Apothecaries Hall Co., Waterbury	J. A. Glasnapp, West Cheshire	none	3.27	3.27	3.29	23.90	20.00	54	46	$40.00	21162
	Slaughter House Tankage *Sampled by Station:*											
21273	American Agricultural Chemical Co., New York City	Robt. Greenbacker, Meriden	0.32	4.58	4.90	4.94	16.20	13.73	51	49	.....	21273
21323	Armour Fertilizer Works, New York City	A. E. Shedd, Norwich	0.68	4.16	4.84	4.94	13.47	13.73	46	54	39.00	21323
20910	Apothecaries Hall Co., Waterbury	Sampled at Factory	0.20	9.64	9.84	7.81	3.38	7.00	56	44	65.00	20910
20919	Conn. Fat Rendering and Fertilizer Corp., New Haven	Sampled at Factory	none	3.74	3.74	3.29	22.28	.....	57	43	45.00	20919
21193	Consolidated Rendering Co., Boston, Mass.	Sampled at Factory, New Haven	0.16	7.05	7.21	7.41	9.65	9.15	37	63	.....	21193
21194	Consolidated Rendering Co., Boston, Mass	Sampled at Factory, New Haven	0.21	4.49	4.70	4.92	13.00	14.00	38	62	.....	21194
21328	Consolidated Rendering Co., Boston, Mass.	C. E. Lyman, Middlefield	0.16	5.46	5.62	4.92	15.80	14.00	33	67	.....	21328
21117	Wilcox Fertilizer Co., Mystic	Sampled at Factory	0.33	6.73	7.06	6.58	11.73	10.00	66	34	.....	21117
21121	Worcester Rendering Co., Auburn, Mass	A. D. Briggs, Pomfret	0.20	7.53	7.73	5.74	10.98	10.00	48	52	.....	21121

TANKAGE.

Ten samples, all drawn by the Station agent have been examined and results are given in Table XII.

Only one of these samples was sold as "bone and meat" tankage but most of the others, by their phosphoric acid content, show the presence of a considerable proportion of bone. Tankage with high phosphoric acid is relatively low in nitrogen.

The utility of the plant food in this material depends to an important degree upon its mechanical condition. In five of the samples examined more than one-half of the material was finer than one-fiftieth of an inch. The fertilizer ingredients in these will be more readily utilized than in the case of coarser products.

There is no consistent comparison in the cost of plant food in the several grades of this product. Taking the four cases in which prices are given, three of them representing goods of about the same degree of fineness, and assuming a uniform value of 6 cents per pound for total phosphoric acid, the cost per pound of nitrogen in **20910** which contains the least bone, is 31 cents. In the other three, which contain relatively large amounts of bone, nitrogen has cost from 17.3 to 24.5 cents per pound.

GROUND BONE.

Twenty-eight samples of ground bone were examined, thirteen of which were drawn by the Station agent and fifteen were submitted by purchasers. The results appear in Table XIII.

Ground bone is a very desirable form of plant food where immediate availability is not essential. It is used to advantage for seeding down and for certain crops which require a long season in which to mature. Like tankage the mechanical condition of the bone meal is important. Of the twenty-eight samples analyzed this year, in twenty-one 50 per cent or more of the material was finer than 1/50th of an inch; in ten, 70 per cent or more was of that degree of fineness. Three samples were very coarse, 30 per cent or less passing 1/50th mesh.

Two samples, **21181** and **21251** were deficient in nitrogen by 0.16 per cent in each case. Samples **20915** and **21054** failed to meet their guaranties for phosphoric acid by 1.30 and 3.68 per cent respectively.

The average nitrogen content of all samples is 3.91 per cent and the average amount of phosphorc acid found is 24.67 per cent. *At the average of prices quoted ($48.41), allowing 22 cents per pound for nitrogen, phosphoric acid from this source has cost 6.3 cents per pound.*

TABLE XIII. ANALYSES OF

Station No.	Manufacturer.	Dealer or Purchaser.
	Sampled by Station:	
21025	American Agricultural Chemical Co., New York................	Bristol Grain & Supply Co., Bristol
21039	Apothecaries Hall Co., Waterbury.	Sampled at Factory..............
21181	Armour Fertilizer Works, New York	John O. Fox, Putnam............
21013	Berkshire Fertilizer Co., Bridgeport	Sampled at Factory..............
21545	E. D. Chittenden Co., Bridgeport..	J. E. Stoddard, Abington.........
20915	Consolidated Rendering Co., Boston	Cheshire Reformatory, Cheshire...
21195	Consolidated Rendering Co., Boston	Sampled at Factory, New Haven..
21101	L. T. Frisbie Co., New Haven....	Jordan Hardware Co., Willimantic
20941	Olds & Whipple, Inc., Hartford...	Rackliffe Bros. Co., New Britain..
21455	Rogers & Hubbard Co., Portland..	Cadwell & Jones, Hartford........
21461	Rogers & Hubbard Co., Portland..	Willimantic Grain Co., Willimantic
21473	F. S. Royster Guano Co., Baltimore	Plumb Bros., Waterbury.........
21483	Sanderson Fertilizer & Chemical Co., New Haven..............	G. W. Thorpe, West Cheshire.....
21134	M. L. Shoemaker & Co., Philadelphia	Olds & Whipple Co., Inc., Hartford
21114	Wilcox Fertilizer Co., Mystic.....	Lyon & Ewald, New London......
	Sampled by Purchaser:	
19947	Apothecaries Hall Co., Waterbury.	H. H. Newell, Marion............
20534	Apothecaries Hall Co., Waterbury.	Hatheway & Steane, Hartford....
20535	Apothecaries Hall Co., Waterbury.	Hatheway & Steane, Hartford....
20536	Apothecaries Hall Co., Waterbury.	Hatheway & Steane, Hartford....
20537	Apothecaries Hall Co., Waterbury.	Hatheway & Steane, Hartford....
20853	Apothecaries Hall Co., Waterbury.	Hatheway & Steane, Hartford....
20854	Apothecaries Hall Co., Waterbury.	Hatheway & Steane, Hartford....
20869	Apothecaries Hall Co., Waterbury.	Hatheway & Steane, Hartford....
20974	Apothecaries Hall Co., Waterbury.	Hatheway & Steane, Hartford....
21054	Apothecaries Hall Co., Waterbury.	J. E. Shepard, South Windsor.....
21251	Armour Fertilizer Works, New York	Walter T. Clark, Norwich........
20695	78653.........................	Conn. Sumatra Tobacco Co., Buckland.........................
20935	....	John H. Fay, Middletown........

GROUND BONE.

Nitrogen.		Phosphoric Acid.		Mechanical Analysis.			
Found.	Guaranteed.	Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	Cost per ton.	Station No.
%	%	%	%	%	%		
3.02	2.47	23.90	22.88	28	72	$55.00	21025
3.77	3.29	25.80	20.00	58	42	55.00	21039
2.31	2.47	27.30	22.00	68	32	55.00	21181
1.85	1.64	26.30	25.00	55	45	40.00	21013
2.39	2.47	26.18	22.00	41	59	50.00	21545
2.36	2.05	24.70	26.00	77	23	42.00	20915
3.17	2.46	26.35	24.00	78	22	.....	21195
3.05	2.46	26.30	20.00	64	36	54.00	21101
2.86	2.50	24.40	22.00	51	49	53.85	20941
3.98	3.82	25.85	24.70	47	53	66.00	21455
3.72	3.29	24.90	20.50	72	28	56.00	21461
2.72	2.47	25.85	22.90	52	48	55.00	21473
2.62	2.47	25.70	22.88	28	72	53.00	21483
5.58	4.53	22.40	20.00	91	9	61.75	21134
2.30	2.05	28.30	25.18	62	38	55.00	21114
3.82	....	26.22	.....	72	28	45.00	19947
4.03	....	23.72	.....	70	30	39.50	20534
3.53	....	25.50	.....	74	26	39.50	20535
3.62	....	25.50	.....	77	23	39.50	20536
4.20	....	23.84	.....	79	21	39.50	20537
4.03	3.29	24.54	20.00	54	46	39.50	20853
4.38	3.29	24.15	20.00	48	52	39.50	20854
3.98	3.29	21.59	20.00	53	47	55.75	20869
3.60	3.29	24.70	20.00	59	41	39.50	20974
4.00	....	19.20	22.88	30	70	42.00	21054
2.54	3.70	26.15	21.50	70	30	39.50	21251
3.45	....	19.83	.....	69	31	.....	20695
3.85	....	21.70	.....	....	....	.....	20935

VI. MIXED FERTILIZERS.

FERTILIZERS CONTAINING PHOSPHORIC ACID AND POTASH.

Two non-nitrogenous fertilizers containing phosphoric acid and potash were analyzed.

21132. *Olympic* brand, made by the Virginia-Carolina Chemical Co. and sampled by the Station agent from the stock of E. O. Chapman, North Haven.

21428. *Bone Phosphate and Potash Compound* made by Olds & Whipple, Inc., Hartford and sampled by the Station agent at the factory.

TABLE XIV. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station: **Berkshire Fertilizer Co., Bridgeport.**			
21335	Berkshire Tobacco Starter....	6-4-0	Thompsonville.....	$53.00
	F. T. Blish Hardware Co., South Manchester.			
21498	Top Dressing for Grass.......	7-4-0	Factory...........	45.75
	Olds & Whipple, Inc., Hartford			
21392	Top Dressing for Grass.......	7-4-0	New Britain.......	49.16
21397	High Grade Tobacco Starter..	10-3-0	Pine Meadow......	.....
	Sanderson Fertilizer & Chemical Co., New Haven.			
21490	Tobacco Grower............	5-4-0	Tariffville.........	.....
	M. L. Shoemaker & Co., Philadelphia, Pa.			
21133	Swift-Sure Superphosphate Tobacco Starter 4-10-0.......	4-10-0	Hartford..........	46.00
21318	Swift-Sure Superphosphate Tobacco Starter 4-10-0.......	4-10-0	Windsor Locks.....	51.00

Analyses are as follows:

Station No.	21132	21428
	%	%
Phosphoric acid:		
citrate-insoluble	1.47	0.30
total	13.28	5.33
available, found	11.81	5.03
guaranteed	12.00	4.00
Potash:		
as muriate	5.81	1.58
total, found	5.81	16.74
guaranteed	6.00	15.00
Cost per ton	$33.00	$42.75

CONTAINING NITROGEN AND PHOSPHORIC ACID.

Nitrogen					Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Station No.
In nitrates.	In ammonia.	Organic. Water-soluble.	Organic. Water-insoluble.	Total.		Citrate-insoluble.	Total.	So-called "Available."	
2.41	0.04	0.01	2.84	5.30	6.4	0.50	5.03	4.53	21335
3.87	0.13	0.25	1.27	5.52	6.7	1.73	6.28	4.55	21498
4.09	....	0.36	1.23	5.68	6.9	1.35	6.00	4.65	21392
0.28	1.00	3.28	5.68	10.24	12.5	0.33	4.25	3.92	21397
0.98	0.10	0.01	3.20	4.29	5.2	0.18	4.58	4.40	21490
1.33	0.03	0.29	1.42	3.07	3.7	2.95	14.18	11.23	21133
1.32	0.08	0.54	1.31	3.25	4.0	3.70	14.40	10.70	21318

MIXED FERTILIZERS CONTAINING NITROGEN AND PHOSPHORIC ACID.

Only seven of the nitrogenous superphosphates examined this year were without potash. The analyses of these are given in Table XIV.

It has become widely established in trade practice to designate the grade or quality of mixed fertilizers by stating as a part of the brand name, or instead of it, the guaranteed amounts of plant food contained in the mixture. Thus, Berkshire Tobacco Starter, 6-4-0 means that the mixture carries 6 per cent of ammonia (NH_3), 4 per cent of available phosphoric acid (P_2O_5), and no potash (K_2O). In order to enable the purchaser to more readily compare the results of our analyses with the claims of the manufacturer our tables of analyses of mixed fertilizers have been somewhat revised. The figures in the column headed "Grade" represent the manufacturer's claim or guaranty as to ammonia, available phosphoric acid and potash in the order named and the corresponding ingredients found by our analysis appear in the tables in bold face type. To apply the interpretation in the instance just cited, Table XIV, No. **21335**, Berkshire Tobacco Starter claimes to contain 6 per cent of ammonia, 4 per cent of available phosphoric acid and no potash; and it appears from the analysis that 6.4 per cent of ammonia and 4.53 per cent of available phosphoric acid were found. No tests were made for potash as none was declared.

Two samples were found deficient in ammonia; they were:

21498. Blish Hardware Co. Top Dressing for Grass 7-4-0, ammonia deficiency 0.3 per cent.

21133. Shoemaker Swift-Sure Superphosphate Tobacco Starter 4-10-0, ammonia deficiency 0.3 per cent.

A second sample, **21318**, of the last named brand was found to fully meet its guaranty.

MIXED FERTILIZERS CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH.

Analyses of two hundred and seventy samples of fertilizers of this class are given in Table XVI. Nine of these were sampled by purchasers and the remainder were official samples drawn by the Station agent.

To facilitate the comparison between composition guaranteed and that found the same change in the arrangement of analyses has been made as has already been described under the preceding heading, Mixed Fertilizers Containing Nitrogen and Phosphoric Acid.

Samples Failing to Meet Guaranties.

A large proportion of the fertilizers in this group have failed to meet their guaranties in all respects. Of the two hundred and

sixty-one officially drawn samples, one hundred and eighteen, or about 45 per cent, were deficient with respect to one or more of the guaranteed ingredients, deficiencies of 0.12 per cent or less in ammonia, 0.20 per cent or less in available phosphoric acid and 0.15 per cent or less in potash being disregarded in arriving at these figures. The number of ammonia deficiencies was greater than the numbers of phosphoric acid and potash deficiencies combined. Ninety-four samples, or 36 per cent were deficient in one ingredient; twenty-four, or 9.2 per cent were deficient in two ingredients; but none were found lacking in all of the ingredients guaranteed.

While it is true that many of these deficiencies are not large, perhaps even within the range of analytical differences which occur between experienced analysts, nevertheless it seems clear that manufacturers too often fix guaranties with an insufficient margin of safety.

From the purchaser's standpoint, however, there may be a compensating consideration because, in many cases, a shortage in one item of plant food is accompanied by an over-run in one or both of the other items and a loss in money value does not necessarily occur. If ammonia, available phosphoric acid and potash are valued at about the average of what they have cost in the various raw materials which we have examined, viz; 30, 7 and 5.5 cents per pound respectively, the number of brands thus shown to be deficient in money value is reduced to seventy-seven. Of these seventy-seven the shortage in money value in thirty-one brands is less than one dollar per ton; but in forty-five brands, or about 17.0 per cent of the official samples in this group, the shortage is one dollar or more per ton. This proportion is much greater than usual. The deficient brands are listed in Table XV.

TABLE XV. DEFICIENT BRANDS, 1923.

No.	Brand.	Approximate deficiency in money value per ton.
21154	A. A. C. Co.'s AA 5-4-5	$1.24
21145	A. A. C. Co.'s Lister's Potato Manure 4-8-7	1.33
21027	A. A. C. Co.'s National Complete Tobacco 5-4-5	1.81
21329	A. A. C. Co.'s National Complete Tobacco 5-4-5	1.37
21151	A. A. C. Co.'s National Market Garden 3-8-4	1.08
21167	A. A. C. Co.'s National XXX Fish and Potash 3-10-3	1.31
21340	A. A. C. Co.'s Quinnipiac Superior Top Dressing 6-6-4	2.91
21012	Armour's Big Crop Fertilizer 4-6-10	1.45
21433	Armour's Big Crop Fertilizer 4-6-10	2.66
21322	Armour's Big Crop Fertilizer 4-8-4	1.28
21011	Armour's Big Crop Fertilizer 5-8-5	1.75
21321	Armour's Big Crop Fertilizer 5-8-7	9.52[1]
21288	Armour's Big Crop Fertilizer 8-6-6	2.39
21336	Armour's Corn Grower, 2-8-4	2.73
21183	Atlantic, 4-8-6	3.47
21552	Atlantic, 4-8-6	1.33

[1] See "Analyses Requiring Special Notice" p 56.

TABLE XV. DEFICIENT BRANDS, 1923—*Concluded.*

No.	Brand.	Approximate deficiency in money value per ton.
21345	Atlantic, Tobacco Grower, 5-4-5	1.74
21284	Bowker's Market Garden 4-8-4	1.01
21289	Bowker's Stockbridge Early Crop 5-8-7	1.58
21285	Bowker's Stockbridge Potato and Vegetable 4-6-10	2.49
21436	Clark's Special Mixture 5-8-5	1.71
21088	Coe-Mortimer, E. F. Coe's Special Potato 4-8-4	4.16
21086	Coe-Mortimer, E. F. Coe's Gold Brand Guano 3-8-4	1.89
21528	Eastern States Formula A 7. 3-2-7. 6	1.71
21092	Frisbie's Market Garden 4-8-6	1.21
21267	Frisbie's Market Garden 4-8-6	1.61
21099	Vegetable and Potato 4-8-4	1.91
21352	Frisbie's Tobacco Manure 5-8-6	2.82
21376	Buffalo Top Dresser 7-6-5	1.56
21098	Lowell Animal Brand 3-8-4	1.24
21553	Mapes Top Dresser 10-4-2	3.20
21403	Nature's Plant Food, 1. 2-3-2	3.75
21420	Frank S. Platt, Platco Special 4-8-6	2.26
21457	Rogers & Hubbard, Corn and General Crops 3-8-6	1.01
21469	Royster's Quality Trucker 4-8-7	1.75
21476	Royster's Top Dresser 7-6-5	3.52
21486	Sanderson, Kelsey's Bone, Fish and Potash 3-10-3	1.43
21492	Springfield, 4-8-6	1.21
21485	Springfield, Potato, Onion and Vegetable 4-8-4	1.02
21141	Virginia-Carolina, Fish, Phosphate and Potash 2-8-2	1.23
21319	Wilcox 5-8-7	1.12
21501	Wilcox Grass and Truck 5-8-4	1.21
21500	Wilcox Potato and Vegetable 4-8-6	1.08
21503	Woodruff & Sons Home Mixed 4-8-6	6.07
21506	Worcester Potato and Vegetable, 4-8-4	4.31

ANALYSES REQUIRING SPECIAL NOTICE.

Manufacturers or jobbers occasionally request that a second sample be secured and analyzed in case our first analysis has shown a deficiency and, so far as possible, we have granted such requests.

21027. National Complete Tobacco, 5-4-5, was deficient in ammonia and the second sample, **21329,** was likewise deficient.

21021. National Premier Truck Manure, 4-8-7, was deficient in potash and the second sample, **21320,** was also deficient in this respect.

21012. Armour's Big Crop, 4-6-10, was deficient in ammonia and available phosphoric acid on the first analysis. The second sample, **21433,** was deficient in ammonia and potash.

21045. Armour's Big Crop, 4-8-4, was low in available phosphoric and the second sample, **21322,** was low in potash.

21047. Armour's Big Crop, 5-8-7, was low in potash. A second sample, **21321,** was found not to conform at all to a 5-8-7 grade and partial analysis of the duplicate left by our agent with the person whose stock was sampled failed to show any error in sampling. No further samples of this brand could be secured.

Evidently another grade of goods had been put in bags marked 5-8-7 by mistake.

21183. Atlantic, 4-8-6, was deficient in ammonia and potash but the second sample, **21552,** was deficient in ammonia only.

21293. Clark's Special Tip Top, 5-8-5, was deficient in ammonia and the second sample, **21436,** was also deficient in this respect.

21298. Essex Market Garden, 4-8-4, was low in ammonia but the second sample, **21435,** fully met the guaranty in all respects.

21092. Frisbie's Market Garden, 4-8-6, was low in ammonia and the second sample, **21267,** was likewise deficient.

21099. Frisbie's Special Vegetable, 4-8-4, was low in both ammonia and potash but the second sample, **21265,** was deficient in ammonia only.

21352. Frisbie's Tobacco Manure, 5-8-6, was low in ammonia but the second sample, **21574,** met the guaranty.

21380. Mapes Tobacco Ash Constituents, 1-4-15, was deficient in potash; the second sample, **21458,** contained about 2 per cent more potash but it was still under guaranty.

21103. Mapes Top Dresser, 10-4-2, was low in ammonia; the second sample, **21153,** was also low in this respect.

20960. Mapes Tobacco Starter, 5-6-1, was low in ammonia but the second sample, **21268,** satisfied the guaranty.

Classification of Grades with Particular Reference to Ammonia.

Attention has been called in previous reports to the relatively higher cost of nitrogen in low priced goods carrying low guaranties of ammonia. It was shown, for example[1], that the cost per pound of nitrogen in goods guaranteed 1 per cent ammonia (0.82 per cent nitrogen), was from two and one-half to three times greater than in brands carrying 3 to 5 per cent ammonia (2.47 to 4.11 nitrogen). A gradual reduction in the proportion of low nitrogen brands is shown by summaries for the last three years as follows:

Guaranty.	Percentage of Samples. 1921	1922	1923
1 per cent ammonia (0.82 nitrogen)	10.0	6.0	4.2
2 per cent ammonia (1.65 nitrogen)	20.4	19.1	16.5
3 per cent ammonia (2.47 nitrogen)	23.2	19.1	16.1
4 per cent ammonia (3.29 nitrogen)	20.4	25.9	26.1
5 per cent ammonia (4.11 nitrogen)	21.4	23.0	24.5
6 per cent ammonia (4.94 nitrogen)	4.6	6.9	4.9
7 to 12 per cent ammonia (5.76 to 9.87 nitrogen)	....	....	7.7
Total	100.0	100.0	100.0

[1]Conn. Exp. Sta., Bull. 241, p. 110

The number of samples carrying guaranties of from 4 to 5 per cent ammonia comprised over 50 per cent of the total number this year.

THE "NEW ENGLAND STANDARD NINE."

At a meeting in Boston in the latter part of December, 1922, New England agronomists and representatives of fertilizer manufacturers discussed and finally adopted a list of high analysis fertilizers which, it was felt, would adequately meet all the reasonable needs of farmers in the New England states. It has long been recognized that the great multiplicity of brands now on the market, many of which differ from one another but very slightly, is an economic disadvantage in that it adds to the cost of manufacture and distribution of fertilizers and serves no real agricultural need. However, competition is keen in the fertilizer business and many brands have established good will values which their manufacturers do not wish to sacrifice. Manufacturers will, therefore, continue to emphasize *brands* until purchasers more generally think in terms of *grades*. It was the sense of this New England conference that the nine grades chosen would satisfy present requirements and that they should be advocated until there is evidence that revision of the list should be made.

The formulas adopted and now known as the "New England Standard Nine" and the number of mixed fertilizers examined by us this year which fall in these respective grades are as follows:

Standard Grade	Number of samples.
0-12-6	1
2-12-4	2
3-10-4	1
3-10-6	0
4-8-4	30
4-8-6	12
5-4-5	23
5-8-7	14
8-6-6	1
Total	84

These figures show that of two hundred and sixty-one "complete" fertilizers and two containing only phosphoric acid and potash, one hundred and seventy-nine do not fall in any of the nine grades here given although many of them approach these grades more or less closely. Only four of the adopted grades are represented by any considerable number of samples and one grade is not represented at all. However, as the purpose of these nine grades becomes better known among manufacturers and users of fertilizers their representation will, no doubt, increase.

Availability of the Organic Nitrogen.

Only three samples showed deficiencies in the quality of the insoluble organic nitrogen by both the alkaline and the neutral methods of evaluation. In these cases, however, the amounts of insoluble organic nitrogen were small (.4 to .5 per cent), and the total nitrogen was in excess of the guaranty in all cases, the excesses being greater than, or practically equal to, the inactive nitrogen found.

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station. No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station: **American Agricultural Chemical Co., New York.**		
20992	Complete Potato Mixture	3-8-4	New Britain
21156	Crescent Complete Manure	2-8-3	Stamford
21154[1]	Double A Tobacco Fertilizer	5-4-5	Portland
21346	Fish and Potash	3-10-3	South Manchester
21030	Grass and Lawn Top Dressing	6-6-4	North Stonington
20993	7% Potash Fertilizer	4-8-7	New Haven
21275	5-4-3 Tobacco Fertilizer	5-4-3	New Milford
21029	Universal Phosphate	1-8-2	New London
21152	Bradley's Complete Manure for Top Dressing Grass and Grain	6-6-4	Groton
21028	Bradley's Complete Manure for Potatoes and Vegetables	4-8-7	East River
21026	Bradley's Complete Tobacco Manure	5-4-5	Glastonbury
20991	Bradley's Corn Phosphate	2-8-2	Bristol
21153	Bradley's Fish Compound	3-10-3	Meriden
20987	Bradley's New Method Fertilizer	1-8-2	Wallingford
21150	Bradley's Potato Fertilizer	2-8-3	East River
21155	Bradley's Potato Manure	3-8-4	Norwalk
21149	Bradley's Superior Tobacco Compound	7-3-7	Glastonbury
20994	Bradley's X. L. Superphosphate of Lime	3-9-2	Suffield
21272	Listers Celebrated Tobacco Fertilizer	5-4-3	West Suffield
20989	Listers Corn and Potato Fertilizer	2-8-3	Yalesville
21024	Listers Eastern Pride Fertilizer	3-8-4	Yalesville
21145[1]	Listers Potato Manure	4-8-7	Yalesville
21146	Listers Standard Pure Superphosphate of Lime	3-9-2	Yalesville
20990	Listers Success Fertilizer	2-8-2	Yalesville
21027[1]	National Complete Tobacco Fertilizer	5-4-5	Broad Brook
21329[1]	National Complete Tobacco Fertilizer	5-4-5	Broad Brook
21151[1]	National Market Garden Fertilizer	3-8-4	New London
20985	National Potato and Corn Phosphate	2-8-3	Wallingford
21021[2]	National Premier Truck Manure	4-8-7	Broad Brook
21320[2]	National Premier Truck Manure	4-8-7	Silver Lane
21549	National Special Tobacco	5-4-3	Suffield
21022	National Top Dressing Compound	6-6-4	Broad Brook
20986	National Universal Phosphate	1-8-2	Wallingford
21173	National White Ash Tobacco Grower	7-3-7	Warehouse Point
21167[1]	National XXX Fish and Potash	3-10-3	Silver Lane

[1] See Table XV, p. 55.
[2] See Note, p. 56.

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH.

Dealer's cash price per ton.	Nitrogen. In nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, water-insoluble.	Nitrogen. Total	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
	%	%	%	%	%	%	%	%	%	%	%	
$46.00	0.48	0.84	0.39	0.69	2.40	**2.92**	0.75	8.84	**8.09**	3.97	**3.97**	**20992**
.....	0.12	0.38	0.51	0.71	1.72	**2.09**	0.63	8.78	**8.15**	2.81	**2.81**	**21156**
57.25	0.98	0.02	none	2.82	3.82	**4.64**	0.38	4.83	**4.45**	1.16	**5.26**	**21154**
46.00	0.48	0.71	0.53	0.70	2.42	**2.94**	0.83	10.85	**10.02**	3.03	**3.03**	**21346**
52.00	2.75	1.21	0.22	0.57	4.75	**5.78**	1.28	7.90	**6.62**	4.13	**4.13**	**21030**
.....	0.72	1.40	0.60	0.65	3.37	**4.10**	0.90	8.78	**7.88**	7.02	**7.02**	**20993**
53.00	1.04	none	0.06	3.02	4.12	**5.01**	0.23	4.70	**4.47**	0.33	**3.10**	**21275**
38.00	none	0.08	0.27	0.56	0.91	**1.11**	0.43	8.89	**8.46**	1.86	**1.86**	**21029**
50.00	3.14	1.18	0.21	0.59	5.12	**6.22**	1.00	7.35	**6.35**	3.98	**3.98**	**21152**
48.00	0.60	1.44	0.68	0.65	3.37	**4.10**	1.30	9.35	**8.05**	6.38	**6.38**	**21028**
57.25	0.96	0.08	none	3.17	4.21	**5.12**	0.35	5.00	**4.65**	0.58	**5.35**	**21026**
40.00	0.10	0.54	0.38	0.63	1.65	**2.01**	0.78	9.06	**8.28**	1.89	**1.89**	**20991**
50.00	0.49	0.69	0.46	0.71	2.35	**2.86**	1.13	11.03	**9.90**	3.16	**3.16**	**21153**
33.00	0.07	0.08	0.09	0.66	0.90	**1.09**	0.80	9.11	**8.31**	2.40	**2.40**	**20987**
.....	0.07	0.48	0.38	0.73	1.66	**2.02**	1.00	9.28	**8.28**	2.93	**2.93**	**21150**
45.00	0.48	0.82	0.45	0.73	2.48	**3.02**	0.68	8.93	**8.25**	4.07	**4.07**	**21155**
67.00	1.17	0.03	0.28	4.40	5.88	**7.15**	0.40	4.18	**3.78**	0.78	**7.67**	**21149**
40.00	0.70	0.82	0.35	0.64	2.51	**3.05**	0.75	9.89	**9.14**	2.11	**2.11**	**20994**
48.60	0.98	0.02	0.02	3.11	4.13	**5.02**	0.28	4.90	**4.62**	0.40	**3.29**	**21272**
40.00	0.02	0.54	0.52	0.59	1.67	**2.03**	0.98	9.12	**8.14**	2.72	**2.72**	**20989**
.....	0.43	0.86	0.39	0.71	2.39	**2.91**	0.80	8.90	**8.10**	3.99	**3.99**	**21024**
.....	0.72	1.28	0.39	0.79	3.18	**3.87**	1.18	9.18	**8.00**	6.50	**6.50**	**21145**
.....	0.49	0.77	0.37	0.71	2.34	**2.84**	0.70	10.00	**9.30**	1.89	**1.89**	**21146**
38.00	0.11	0.45	0.35	0.56	1.53	**1.86**	0.78	9.40	**8.62**	1.97	**1.97**	**20990**
59.50	0.52	0.06	0.16	3.06	3.80	**4.62**	0.35	4.78	**4.43**	0.54	**4.88**	**21027**
56.60	0.68	0.04	0.08	3.05	3.85	**4.68**	0.25	4.61	**4.36**	0.47	**5.05**	**21329**
50.00	0.68	0.62	0.55	0.54	2.39	**2.91**	0.65	8.51	**7.86**	3.69	**3.69**	**21151**
.....	0.16	0.56	0.36	0.72	1.80	**2.19**	1.03	9.15	**8.12**	3.00	**3.00**	**20985**
45.70	0.70	1.36	0.71	0.61	3.38	**4.11**	1.00	9.03	**8.03**	6.56	**6.56**	**21021**
.....	0.75	1.37	0.61	0.62	3.35	**4.07**	1.03	9.03	**8.00**	6.59	**6.59**	**21320**
54.00	0.98	0.03	0.11	3.00	4.12	**5.01**	0.30	4.60	**4.30**	0.36	**3.62**	**21549**
49.30	2.99	1.17	0.45	0.60	5.21	**6.33**	0.83	7.05	**6.22**	4.06	**4.06**	**21022**
.....	0.11	0.11	0.15	0.62	0.99	**1.20**	0.73	8.99	**8.26**	2.04	**2.04**	**20986**
68.00	0.95	0.12	0.53	4.10	5.70	**6.93**	0.28	3.95	**3.67**	0.78	**6.92**	**21173**
.....	0.45	0.75	0.42	0.71	2.33	**2.83**	1.03	10.75	**9.72**	3.09	**3.09**	**21167**

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station: **American Agricultural Chemical Co., New York**—*Continued.*		
21048	Quinnipiac Corn Manure	2-8-2	North Stonington
21164	Quinnipiac Fish and Potash Phosphate	3-10-3	North Haven
21172	Quinnipiac Market Garden Manure	4-8-7	Gaylordsville
21049	Quinnipiac Phosphate	3-9-2	North Stonington
21046	Quinnipiac Potato Phosphate	2-8-3	North Haven
21165	Quinnipiac Prime Tobacco Manure	7-3-7	Manchester
21166	Quinnipiac Seed Leaf Tobacco Manure	5-4-5	Manchester
21340[1]	Quinnipiac Superior Top Dressing Manure	6-6-4	Melrose
21341	Quinnipiac Wrapper Leaf Brand Tobacco Manure	5-4-3	Windsor
21339	Wheeler's Ammoniated Fish Manure	3-10-3	Northford
21171	Wheeler's Corn Fertilizer	2-8-2	New Milford
21274	Wheeler's Cuban Tobacco Grower	5-4-5	New Milford
21344	Wheeler's Early Market Compound	4-8-7	Huntington
21337	Wheeler's Potato Manure	2-8-3	Thomaston
21338	Wheeler's Royal Wheat Grower	1-8-2	Thomaston
21343	Wheeler's Universal Mixture	3-8-4	Huntington
	Apothecaries Hall Co., Waterbury.		
21050	Liberty Corn, Fruit and All Crops	2-8-2	Willimantic
20940	Liberty Fish, Bone and Potash	3-8-3	Meriden
21019	Liberty High Grade Market Gardeners	5-8-7	Meriden
21163	Liberty High Grade Tobacco Special	8-4-5	East Windsor
21015	Liberty Market Gardeners' Special	4-8-4	Cheshire
21170	Liberty Tobacco Special	5-4-5	East Windsor
21270	Liberty Top Dresser for Grass and Grain	7-8-3	East Windsor
	Armour Fertilizer Works, New York.		
21282	Armour's Big Crop Fertilizer, 2-12-2	2-12-2	Rockville
21020	Armour's Big Crop Fertilizer, 3-8-4	3-8-4	Thompsonville
21012[1]	Armour's Big Crop Fertilizer, 4-6-10	4-6-10	New Haven
21433[1]	Armour's Big Crop, 4-6-10	4-6-10	Guilford
21045[2]	Armour's Big Crop, 4-8-4	4-8-4	Guilford
21322[1]	Armour's Big Crop, 4-8-4	4-8-4	Norwich

[1] See Table XV, p. 55.
[2] See Note, p. 56

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

Dealer's cash price per ton.	Nitrogen. In nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
	%	%	%	%	%	%	%	%	%	%	%	
$38.00	0.08	0.52	0.61	0.45	1.66	**2.02**	1.01	8.92	**7.91**	2.08	**2.08**	21048
43.00	0.40	0.78	0.53	0.73	2.44	**2.97**	0.97	10.63	**9.66**	2.97	**2.97**	21164
46.00	0.57	1.43	0.67	0.62	3.29	**4.00**	1.07	9.02	**7.95**	7.22	**7.22**	21172
42.00	0.66	0.72	0.64	0.51	2.53	**3.08**	0.72	9.65	**8.93**	2.05	**2.05**	21049
40.00	0.15	0.58	0.42	0.63	1.78	**2.16**	1.02	9.12	**8.10**	3.26	**3.26**	21046
.....	0.96	0.12	0.65	4.15	5.88	**7.15**	0.33	4.15	**3.82**	1.14	**7.09**	21165
.....	0.94	0.02	0.12	2.96	4.04	**4.91**	0.38	4.73	**4.35**	0.57	**4.86**	21166
50.00	2.33	1.06	0.49	0.50	4.38	**5.33**	0.83	7.58	**6.75**	4.05	**4.05**	21340
48.00	1.10	none	none	3.20	4.30	**5.23**	0.30	4.78	**4.48**	0.39	**3.66**	21341
40.00	0.35	0.73	0.65	0.68	2.41	**2.93**	1.08	11.08	**10.00**	2.95	**2.95**	21339
.....	0.18	0.47	0.34	0.66	1.65	**2.01**	0.93	9.20	**8.27**	2.09	**2.09**	21171
.....	1.68	none	0.04	2.43	4.15	**5.05**	0.28	4.21	**3.93**	0.56	**4.50**	21274
.....	0.69	1.34	0.67	0.57	3.27	**3.98**	1.15	9.20	**8.05**	6.67	**6.67**	21344
.....	0.08	0.38	0.55	0.72	1.73	**2.10**	0.67	8.63	**7.96**	3.00	**3.00**	21337
.....	0.13	0.31	0.26	0.52	1.22	**1.48**	0.60	8.73	**8.13**	2.54	**2.54**	21338
.....	0.50	0.86	0.38	0.73	2.47	**3.00**	0.63	8.90	**8.27**	3.86	**3.86**	21343
34.00	0.15	0.43	0.23	1.43	2.24	**2.72**	1.40	10.28	**8.88**	2.43	**2.43**	21050
61.00	0.11	2.14	0.68		2.93	**3.56**	0.88	9.63	**8.75**	3.01	**3.01**	20940
57.00	0.98	2.70	0.07	0.54	4.29	**5.22**	0.58	9.68	**9.10**	6.78	**6.78**	21019
67.50	0.33	3.22	0.15	2.98	6.68	**8.12**	0.55	6.63	**6.08**	0.60	**5.65**	21163
46.00	0.18	2.82	0.20	0.41	3.61	**4.39**	0.70	9.08	**8.38**	4.36	**4.36**	21015
55.00	0.16	1.12	1.10	2.22	4.60	**5.59**	0.63	6.13	**5.50**	0.54	**6.22**	21170
56.00	0.16	5.14	0.20	0.50	6.00	**7.29**	0.75	10.15	**9.40**	3.20	**3.20**	21270
44.00	0.18	1.00	0.13	0.45	1.76	**2.14**	0.51	12.15	**11.64**	2.03	**2.03**	21282
42.00	0.16	0.52	0.18	0.53	2.39	**2.91**	0.53	8.64	**8.11**	3.93	**3.93**	21020
50.00	1.15	1.03	0.28	0.62	3.08	**3.74**	0.35	6.13	**5.78**	10.38	**10.38**	21012
41.50	0.96	1.02	0.35	0.82	3.15	**3.83**	0.35	6.20	**5.85**	8.70	**8.70**	21433
38.75	1.41	0.98	0.26	0.64	3.29	**4.00**	0.84	8.44	**7.60**	4.06	**4.06**	21045
34.75	1.21	0.95	0.22	0.79	3.17	**3.85**	0.65	8.53	**7.88**	3.81	**3.81**	21322

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station: **Armour Fertilizer Works, New York** —*Continued.*		
21043	Armour's Big Crop Fertilizer Tobacco Special, 5-4-5	5-4-5	Rockville
21011[1]	Armour's Big Crop Fertilizer, 5-8-5.	5-8-5	New Haven
21047[2]	Armour's Big Crop Fertilizer, 5-8-7	5-8-7	Madison
21321[1]	Armour's Big Crop, 5-8-7	5-8-7	Norwich
21480[3]	Armour's Big Crop, 5-8-7	5-8-7	Norwich
21288[1]	Armour's Big Crop Grass, 8-6-6	8-6-6	Putnam
21336[1]	Armour's Corn Grower	2-8-4	Branford
	Atlantic Packing Co., New Haven		
21183[1]	Atlantic, 4-8-6	4-8-6	Norwich
21552[1]	Atlantic, 4-8-6	4-8-6	Factory
21108	Atlantic Grain Fertilizer, 2-8-2	2-8-2	South Windsor
21290	Atlantic Potato Phosphate, 3-8-4	3-8-4	Waterbury
21182	Atlantic Special Vegetable, 4-8-4	4-8-4	Norwich
21345[1]	Atlantic Tobacco Grower, 5-4-5	5-4-5	Glastonbury
21342	Atlantic Tobacco Manure, 5-8-6	5-8-6	East Hartford
	Berkshire Fertilizer Co., Bridgeport.		
21063	Berkshire, 5-8-7	5-8-7	Woodstock
21178	Berkshire Ammoniated Bone Phosphate	1-10-2	Centerbrook
21064	Berkshire Complete Fertilizer	3-8-3	Woodstock
21184	Berkshire Complete Tobacco	5-3-5	New Milford
21177	Berkshire Grass Special	7-4-4	Centerbrook
21065	Berkshire Market Garden	4-8-4	Woodstock
21014	Berkshire Potato and Vegetable	2-8-2	Ansonia
21355	Berkshire Tobacco Special	7-3-5	Suffield
	F. T. Blish Hardware Co., South Manchester.		
21113	Complete Market Garden	4-8-4	Factory
21505	Complete Tobacco Fertilizer	5-3-5	Factory
21112	Potato Phosphate	2-8-2	Factory
	F. E. Boardman, Middletown.		
21185	Boardman's Fertilizer, Potato and General Crops	4-7-4	Factory
21356	Boardman's Tobacco Fertilizer	4-7-4	Middletown

[1] See Table XV, p. 55.
[2] See Note, p. 56.
[3] Duplicate of 21321.

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

Dealer's cash price per ton.	Nitrogen.					Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Potash.		Station No.
	In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Total		Citrate-insoluble.	Total.	So-called "Available."	As muriate.	Total.	
	%	%	%	%	%	%	%	%	%	%	%	
$64.00	0.89	0.03	0.20	3.55	4.67	5.68	0.43	4.40	3.97	0.62	5.53	21043
52.00	1.50	1.18	0.35	0.86	3.89	4.73	0.63	8.70	8.07	4.79	4.79	21011
50.00	1.46	1.37	0.36	0.85	4.04	4.91	0.70	8.83	8.13	6.76	6.76	21047
39.50	1.02	0.85	0.11	0.69	2.67	3.25	0.60	11.43	10.83	4.29	4.29	21321
......	.....	.....	.....	.....	2.80	3.40	.....	.....	.....	.....	.....	21480
62.15	1.44	3.16	0.28	1.44	6.32	7.68	0.24	5.90	5.66	6.01	6.01	21288
43.00	0.11	0.81	0.25	0.41	1.58	1.92	0.55	8.53	7.98	1.98	1.98	21336
.....	1.03	0.75	0.54	0.62	2.94	3.57	1.65	9.51	7.86	5.37	5.37	21183
.....	1.03	0.75	0.45	0.76	2.99	3.64	0.73	9.30	8.57	6.03	6.03	21552
.....	0.98	0.06	0.17	0.50	1.71	2.08	0.47	8.11	7.64	2.14	2.14	21108
44.75	1.34	0.06	0.58	0.70	2.68	3.26	0.68	9.33	8.65	3.62	3.62	21290
.....	1.33	0.52	0.34	1.01	3.20	3.89	0.50	8.74	8.24	4.00	4.00	21182
53.30	1.38	0.04	0.44	1.78	3.64	4.43	0.23	5.15	4.92	0.73	5.36	21345
50.00	1.16	0.04	0.69	2.19	4.08	4.96	0.45	9.40	8.95	0.74	6.37	21342
40.50	2.27	0.59	0.38	0.78	4.02	4.89	1.39	9.39	8.00	7.19	7.19	21063
38.00	none	0.24	0.52	0.30	1.06	1.29	1.08	11.85	10.77	2.03	2.03	21178
31.50	0.92	0.54	0.53	0.86	2.85	3.46	1.94	9.81	7.87	3.47	3.47	21064
.....	0.90	0.10	0.14	3.00	4.14	5.03	0.18	4.53	4.35	0.57	5.98	21184
55.00	4.58	0.02	0.58	1.06	6.24	7.59	1.83	5.59	3.76	3.91	3.91	21177
35.25	1.76	0.60	0.41	0.65	3.42	4.16	1.62	9.44	7.82	4.75	4.75	21065
38.00	0.70	0.42	0.56	0.30	1.98	2.41	1.55	9.36	7.81	2.34	2.34	21014
.....	1.24	0.30	0.72	3.41	5.67	6.89	0.18	5.08	4.90	0.90	5.68	21355
41.75	1.91	0.17	0.12	1.39	3.59	4.36	1.66	10.16	8.50	3.50	4.17	21113
53.20	0.82	0.06	0.16	3.24	4.28	5.20	0.20	4.18	3.98	0.77	5.46	21505
33.05	0.76	0.18	none	0.76	1.70	2.07	1.23	9.80	8.57	2.47	2.47	21112
41.00	1.46	0.34	0.44	1.10	3.34	4.06	1.19	8.03	6.84	3.46	3.99	21185
40.50	1.56	0.30	0.35	1.25	3.46	4.21	0.78	8.20	7.42	0.31	4.66	21356

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	Bowker Fertilizer Co., New York.		
21018	Bowker's All Round Fertilizer......	3-8-4	Yalesville..........
21179	Bowker's Corn, Grain and Grass Phosphate....................	2-8-2	New London........
21176	Bowker's Fisherman's Brand Fish and Potash....................	3-10-3	Plainville...........
21284[1]	Bowker's Market Garden Fertilizer.	4-8-4	New London........
21017	Bowker's Potato and Vegetable Phosphate....................	2-8-3	Plantsville..........
21368	Bowker's Square Brand Farm and Garden Phosphate..............	2-8-2	Plainville...........
21016	Bowker's Sure Crop Phosphate.....	1-8-2	Plantsville..........
21289[1]	Stockbridge Early Crop Manure....	5-8-7	Rockville...........
21285[1]	Stockbridge Potato and Vegetable Manure......................	4-6-10	Willimantic.........
21360	Stockbridge Premier Tobacco Grower..........................	7-3-7	South Manchester...
21281	Stockbridge Tobacco Manure......	5-4-5	Thompsonville......
21280	Stockbridge Truck Manure........	4-8-7	Plantsville..........
	Amos D. Bridge's Sons, Inc., Hazardville.		
21080	Corn, Onion and Potato and General Purpose......................	4-8-4	Factory............
21081	Special Tobacco Fertilizer.........	5-3-5	Factory............
	The E. D. Chittenden Co., Bridgeport.		
21082	Chittenden's Complete Grain......	2-8-3	Broad Brook........
21357	Chittenden's High Grade Tobacco..	6.5-3-7.5	Broad Brook........
21200	Chittenden's Potato Special 4% Potash......................	4-8-4	Abington...........
21204	Chittenden's Potato Special 6% Potash......................	4-8-6	Poquonock.........
21083	Chittenden's Tobacco Special 3% Potash......................	5-4-5	Broad Brook........
	E. B. Clark Seed Co., Milford.		
21297	Clark's 3-8-2....................	3-8-2	Factory............
21294	Clark's Special Mixture with 4% Potash Fertilizer..............	4-8-4	Branford...........
21295	Clark's Special Mixture with 6% Potash......................	4-8-6	Branford...........
21293	Clark's Special Mixture Tip Top Brand	5-8-5	Branford...........
21436[1]	Clark's Special Mixture Tip Top Brand	5-8-5	Factory............

[1] See Table XV, p. 55.

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

Dealer's cash price per ton.	Nitrogen.					Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Potash.		Station No.
	In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Total.		Citrate-insoluble.	Total.	So-called "Available."	As muriate.	Total.	
	%	%	%	%	%	%	%	%	%	%	%	
$49.75	0.48	0.84	0.40	0.74	2.46	**2.99**	0.75	8.80	**8.05**	4.27	**4.27**	**21018**
35.00	0.09	0.37	0.65	0.51	1.62	**1.97**	0.43	8.61	**8.18**	2.10	**2.10**	**21179**
44.00	0.41	0.76	0.55	0.72	2.44	**2.97**	0.90	10.60	**9.70**	3.05	**3.05**	**21176**
45.00	0.92	1.20	0.50	0.54	3.16	**3.84**	0.49	8.56	**8.07**	3.86	**3.86**	**21284**
35.00	0.22	0.52	0.36	0.70	1.80	**2.19**	1.00	9.23	**8.23**	3.46	**3.46**	**21017**
39.00	0.10	0.50	0.34	0.64	1.58	**1.92**	0.88	9.05	**8.17**	1.89	**1.89**	**21368**
33.00	0.20	0.38	0.25	0.65	1.48	**1.80**	0.78	9.00	**8.22**	3.09	**3.09**	**21016**
54.00	0.72	2.06	0.58	0.61	3.97	**4.83**	0.96	8.78	**7.82**	6.72	**6.72**	**21289**
46.00	0.83	1.20	0.46	0.52	3.01	**3.66**	0.40	6.69	**6.29**	9.22	**9.22**	**21285**
74.00	0.96	0.06	0.40	4.46	5.88	**7.15**	0.28	4.25	**3.97**	0.70	**7.22**	**21360**
55.00	0.02	0.04	1.15	2.95	4.16	**5.06**	0.38	4.70	**4.32**	0.70	**5.18**	**21281**
41.00	0.65	1.35	0.67	0.59	3.26	**3.96**	1.00	8.93	**7.93**	6.93	**6.93**	**21280**
43.50	1.50	0.09	0.28	1.50	3.37	**4.10**	1.53	9.73	**8.20**	4.23	**4.23**	**21080**
54.00	1.00	0.08	0.11	3.16	4.35	**5.29**	0.20	4.40	**4.20**	0.70	**6.03**	**21081**
32.00	0.17	1.02	0.16	0.69	2.04	**2.48**	0.99	8.60	**7.61**	3.13	**3.13**	**21082**
69.00	1.08	2.10	0.13	1.75	5.06	**6.15**	0.20	4.83	**4.63**	0.62	**7.56**	**21357**
43.00	1.51	1.11	0.08	0.67	3.37	**4.10**	0.90	9.28	**8.38**	3.97	**3.97**	**21200**
45.00	0.98	1.64	0.05	0.62	3.29	**4.00**	1.15	9.28	**8.13**	5.76	**5.76**	**21204**
56.00	0.85	1.71	0.14	1.44	4.14	**5.03**	0.25	6.30	**6.05**	0.70	**5.44**	**21083**
34.00	0.15	1.53	0.28	0.36	2.32	**2.82**	1.68	11.90	**10.22**	2.74	**2.74**	**21297**
41.00	0.06	2.46	0.25	0.32	3.09	**3.76**	1.50	10.88	**9.38**	3.34	**3.34**	**21294**
42.00	0.10	2.40	0.26	0.34	3.10	**3.77**	1.38	9.60	**8.22**	7.12	**7.12**	**21295**
44.00	0.56	2.56	0.28	0.52	3.92	**4.77**	1.38	9.30	**7.92**	5.51	**5.51**	**21293**
43.00	2.20	1.00	0.24	0.35	3.79	**4.61**	1.83	10.28	**8.45**	5.00	**5.00**	**21436**

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	The Coe-Mortimer Co., New York.		
21088[1]	E. Frank Coe's Celebrated Special Potato Fertilizer	4-8-4	Colchester
21089	E. Frank Coe's Columbian Corn and Potato Fertilizer	2-8-3	Colchester
21302	E. Frank Coe's Connecticut Wrapper Grower	5-4-5	Simsbury
21086[1]	E. Frank Coe's Gold Brand Excelsior Guano	3-8-4	Milford
21087	E. Frank Coe's New Englander Special	1-8-2	Saybrook
21197	E. Frank Coe's Red Brand Excelsior Guano	4-8-7	Colchester
21196	E. Frank Coe's Special Grass Top Dressing	6-6-4	Milford
21359	E. Frank Coe's Tobacco Leaf Fertilizer	5-4-3	Bloomfield
	Eastern States Farmers' Exchange, Springfield, Mass.		
21550	Eastern States, 2-8-2	2-8-2	Bloomfield
21085	Eastern States, 3-12-3	3-12-3	Branford
21084	Eastern States, 4-8-4	4-8-4	Branford
21291	Eastern States, 4-8-7	4-8-7	Branford
21203	Eastern States, 5-8-7 No-Filler Fertilizer	5-8-7	Ellington
21202	Eastern States, 5-10-5 No-Filler Fertilizer	5-10-5	Ellington
21299	Eastern States, 7-8-3 No-Filler Fertilizer	7-8-3	Ellington
21528[1]	Eastern States, Formula A	7.3-2-7.6	Granby
21515	Eastern States, Formula B	6.6-3.5-5	Ellington
21527	Eastern States, Formula C	6.5-3-5.5	Ellington
	Essex Fertilizer Co., Boston, Mass.		
21079	Essex 2-8-2 for Farm and Garden	2-8-2	Wallingford
21078	Essex Fish Fertilizer for all Crops, 3-8-4	3-8-4	Wallingford
21351	Essex 4-6-10 for Potatoes and Vegetables	4-6-10	South Manchester
21298	Essex Market Garden for Potatoes, Roots and Vegetables, 4-8-4	4-8-4	South Manchester
21435[2]	Essex Market Garden for Potatoes, Roots and Vegetables, 4-8-4	4-8-4	Wallingford
21350	Essex Potato Phosphate, 4:8-7	4-8-7	South Manchester
21354	Essex Tobacco, 5-4-5	5-4-5	East Granby

[1] See Table XV, p. 55.
[2] See Note, p. 56.

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

Dealer's cash price per ton.	Nitrogen.					Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Potash.		Station No.
	In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Total.		Citrate-insoluble.	Total.	So-called "Available."	As muriate.	Total.	
	%	%	%	%	%	%	%	%	%	%	%	
$47.50	0.73	0.87	0.61	0.51	2.72	3.31	0.73	9.03	8.30	3.60	3.60	21088
39.35	0.04	0.46	0.70	0.50	1.70	2.07	0.55	8.33	7.78	3.03	3.03	21089
.....	1.07	0.03	0.08	2.93	4.11	5.00	0.33	4.68	4.35	0.54	5.22	21302
45.00	0.39	0.81	0.34	0.66	2.20	2.67	0.73	9.05	8.32	3.67	3.67	21086
33.00	0.54	0.46	0.20	0.66	1.86	2.26	0.83	8.70	7.87	2.57	2.57	21087
50.70	0.93	1.23	0.44	0.63	3.23	3.93	0.90	8.66	7.76	7.40	7.40	21197
52.00	2.70	1.14	0.48	0.64	4.96	6.03	0.90	7.30	6.40	4.51	4.51	21196
60.00	1.04	0.04	none	3.12	4.20	5.11	0.30	4.84	4.54	0.32	3.32	21359
.....	0.04	1.10	0.24	0.34	1.72	2.09	0.45	8.44	7.99	1.95	1.95	21550
41.00	0.63	1.21	0.24	0.42	2.50	3.04	1.14	13.29	12.15	3.00	3.00	21085
41.50	0.83	1.78	0.30	0.37	3.28	3.99	0.65	8.90	8.25	3.65	4.03	21084
43.50	0.98	1.82	0.45	0.33	3.58	4.35	0.63	9.50	8.87	5.89	5.89	21291
43.65	0.02	2.56	0.52	0.90	4.00	4.86	0.58	10.18	9.60	5.91	5.91	21203
44.00	0.15	2.53	0.46	1.00	4.14	5.03	0.93	11.05	10.12	5.02	5.02	21202
45.90	0.19	4.53	0.44	0.56	5.72	6.95	0.63	9.10	8.47	2.93	2.93	21299
71.00	1.36	0.46	0.64	2.52	4.98	6.05	1.48	8.03	6.55	2.58	7.07	21528
61.10	0.18	1.22	0.46	3.80	5.66	6.88	0.35	4.50	4.15	1.04	5.40	21515
.....	1.00	0.16	0.21	3.77	5.14	6.25	0.18	5.98	5.80	1.46	5.30	21527
36.00	0.90	0.06	0.25	0.44	1.65	2.01	0.63	9.30	8.67	2.39	2.39	21079
41.00	0.66	1.00	0.19	0.61	2.46	2.99	0.43	9.18	8.75	4.57	4.57	21078
56.00	1.00	0.80	0.57	0.91	3.28	3.99	0.50	7.03	6.53	10.16	10.16	21351
50.00	0.99	0.83	0.63	0.69	3.14	3.82	0.73	9.23	8.50	3.88	3.88	21298
43.00	1.02	0.88	0.47	1.04	3.41	4.14	0.65	9.10	8.45	4.28	4.28	21435
53.00	0.89	1.11	0.34	0.98	3.32	4.04	0.60	8.75	8.15	6.61	6.61	21350
59.75	1.24	0.27	0.70	1.75	3.96	4.81	0.85	5.58	4.73	0.60	5.56	21354

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station: **L. T. Frisbie Co., New Haven.**		
21093	Frisbie's 5-8-7	5-8-7	West Cheshire
20904	Frisbie's 5-10-5	5-10-5	Woodmont
21100	Frisbie's Corn and Grain Fertilizer 2-8-2	2-8-2	Jewett City
21092[1]	Frisbie's Market Garden, 4-8-6	4-8-6	West Cheshire
21267[1]	Frisbie's Market Garden, 4-8-6	4-8-6	Norwich
21511	Frisbie's Special, 3-8-4	3-8-4	Jewett City
21099[1]	Frisbie's Special Vegetable and Potato Grower, 4-8-4	4-8-4	Guilford
21265[2]	Frisbie's Special Vegetable and Potato Grower, 4-8-4	4-8-4	West Cheshire
21353	Frisbie's Tobacco Grower, 5-4-5	5-4-5	Rockville
21352[1]	Frisbie's Tobacco Manure, 5-8-6	5-8-6	Rockville
21574[2]	Frisbie's Tobacco Manure, 5-8-6	5-8-6	Burnside
21349	Frisbie's Top Dresser, 7-5-4	7-5-4	Wethersfield
	International Agricultural Corp., Boston, Mass.		
21372	Buffalo Complete Tobacco	4-4-4	East Granby
21374	Buffalo Economy	2-8-2	Wallingford
21375	Buffalo High Grade Manure	4-6-10	Wallingford
21373	Buffalo New England Special	2-12-4	East Granby
21377	Buffalo Tobacco Producer	5.5-5-5.5	North Granby
21376[1]	Buffalo Top Dresser and Starter	7-6-5	Wallingford
	Lowell Fertilizer Co., Boston, Mass.		
20913	Lowell 2-8-3, Vegetables and Grain	2-8-3	Cheshire
21369	Lowell 4-6-10, Potatoes and Vegetables	4-6-10	Moosup
20912	Lowell 4-8-4 for Potatoes, Corn and Vegetables	4-8-4	Cheshire
21094	Lowell 5-8-7 for Potatoes and Vegetables	5-8-7	Southington
21098[1]	Lowell Animal Brand, 3-8-4	3-8-4	Suffield
21367	Lowell Bone Fertilizer, 2-8-2, for Corn, Grain, Grass and Vegetables	2-8-2	Southington
21371	Lowell Potato Phosphate, 4-8-7	4-8-7	Warehouse Point
21378	Lowell 5-4-5 for Tobacco, Fruits and Vines	5-4-5	Granby
21370	Lowell Tobacco Manure, 5-8-6	5-8-6	Warehouse Point
20914	Lowell 7-5-2 Top Dresser	7-5-2	Cheshire

[1] See Table XV, p. 55.
[2] See Note, p. 56.

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

Dealer's cash price per ton.	Nitrogen. In nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
	%	%	%	%	%	%	%	%	%	%	%	
$49.00	1.60	0.88	0.57	0.95	4.00	**4.86**	0.90	9.70	**8.80**	6.99	**6.99**	**21093**
46.00	1.75	0.98	0.62	0.78	4.13	**5.02**	0.20	10.84	**10.64**	5.34	**5.34**	**20904**
34.00	0.91	0.03	0.34	0.36	1.64	**1.99**	0.65	8.65	**8.00**	2.01	**2.01**	**21100**
45.00	1.03	0.73	0.43	0.73	2.92	**3.55**	0.40	8.88	**8.48**	6.74	**6.74**	**21092**
44.00	1.04	0.74	0.52	0.64	2.94	**3.57**	0.48	8.88	**8.40**	6.37	**6.37**	**21267**
39.00	1.02	0.38	0.15	0.88	2.43	**2.95**	1.16	9.20	**8.04**	4.01	**4.01**	**21511**
38.75	1.20	0.52	0.56	0.74	3.02	**3.67**	1.33	9.53	**8.20**	3.81	**3.81**	**21099**
43.00	1.30	0.48	0.62	0.78	3.18	**3.87**	1.30	9.74	**8.44**	0.45	**3.94**	**21265**
61.00	1.23	0.27	0.55	1.90	3.95	**4.80**	1.05	5.63	**4.58**	0.58	**5.35**	**21353**
63.00	1.46	0.24	0.88	0.92	3.50	**4.26**	0.55	9.18	**8.63**	0.82	**6.67**	**21352**
.....	.....	.....	.....	.....	4.28	**5.20**	1.25	10.38	**9.13**	0.94	**6.56**	**21574**
.....	4.36	0.02	0.64	0.62	5.64	**6.86**	0.68	6.13	**5.45**	4.44	**4.44**	**21349**
.....	0.09	1.31	0.10	1.82	3.32	**4.04**	0.25	4.58	**4.33**	0.20	**4.07**	**21372**
36.50	0.34	0.26	0.38	0.82	1.80	**2.19**	2.20	10.58	**8.38**	2.39	**2.39**	**21374**
47.00	1.00	0.56	0.50	1.24	3.30	**4.01**	0.85	7.28	**6.43**	8.60	**8.60**	**21375**
.....	0.93	0.07	0.31	0.49	1.80	**2.19**	0.70	13.15	**12.45**	4.40	**4.40**	**21373**
60.60	0.22	2.42	0.03	1.83	4.50	**5.47**	0.23	6.05	**5.82**	0.58	**5.47**	**21377**
56.00	0.91	2.45	0.24	1.80	5.40	**6.57**	0.60	7.50	**6.90**	1.57	**4.78**	**21376**
30.00	0.84	0.08	0.21	0.53	1.66	**2.02**	0.43	9.85	**9.42**	3.08	**3.08**	**20913**
53.00	1.10	0.82	0.53	0.84	3.29	**4.00**	0.50	6.93	**6.43**	10.21	**10.21**	**21369**
37.00	1.03	0.82	0.39	1.00	3.24	**3.94**	0.53	8.83	**8.30**	4.05	**4.05**	**20912**
59.00	1.32	1.26	0.57	0.93	4.08	**4.96**	0.55	9.06	**8.51**	6.88	**6.88**	**21094**
40.00	0.79	0.46	0.31	0.68	2.24	**2.72**	0.53	8.81	**8.28**	4.04	**4.04**	**21098**
41.00	0.55	0.08	0.45	0.56	1.64	**1.99**	0.68	9.10	**8.42**	2.10	**2.10**	**21367**
39.75	1.02	0.90	0.24	1.08	3.24	**3.94**	0.73	9.18	**8.45**	6.81	**6.81**	**21371**
58.00	1.21	0.29	0.63	1.70	3.83	**4.66**	1.08	5.60	**4.52**	0.47	**5.35**	**21378**
57.75	1.56	0.36	0.77	1.24	3.93	**4.78**	0.75	9.00	**8.25**	1.02	**6.33**	**21370**
47.00	0.17	4.88	0.25	0.19	5.49	**6.67**	0.10	6.00	**5.90**	2.13	**2.13**	**20914**

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	Mapes Fertilizer and Peruvian Guano Co., New York.		
21096	The Mapes Connecticut Valley Special	6-4-7	Suffield
21097	The Mapes Corn Manure	3-8-3	Suffield
21387	The Mapes General Tobacco Manure	5-4-5	Glastonbury
21102	The Mapes General Truck Manure	5-6-5	Hartford
21385	The Mapes General Use Manure	3-6-4	Hartford
21390	The Mapes Grain Brand	2-8-2	Hartford
21384	The Mapes Onion Manure	4-6-4	Hartford
21095	The Mapes Potato Manure	4-7-5	Suffield
21380[2]	The Mapes Tobacco Ash Constituents	1-4-15	Suffield
21548[2]	The Mapes Tobacco Ash Constituents	1-4-15	West Suffield
20959	The Mapes Tobacco Manure Wrapper Brand	7.5-2-10.5	Warehouse Point
20960[2]	The Mapes Tobacco Starter Improved	5-6-1	Warehouse Point
21268[2]	The Mapes Tobacco Starter Improved	5-6-1	Hartford
21553[1]	The Mapes Top Dresser	10-4-2	Hartford
21103[2]	The Mapes Top Dresser	10-4-2	Hartford
	Meech & Stoddard, Inc., Middletown.		
21544	Bixota Brand Fertilizer, 2-8-2	2-8-2	Factory
21543	Bixota Brand Fertilizer, 3-8-3	3-8-3	Factory
21542	Bixota Brand Fertilizer, 4-8-4	4-8-4	Factory
21541	Bixota Brand Fertilizer, 5-8-7	5-8-7	Factory
	Nature's Plant Food Co., Boston, Mass.		
21403[1]	Nature's Plant Food	1.2-3-2	Groton
	New England Fertilizer Co., Boston, Mass.		
21386	New England 2-8-3 for Vegetables and Grain	2-8-3	Meriden
21391	New England 4-8-4 for Potatoes and Vegetables	4-8-4	Hamburg
21382	New England Corn Phosphate 2-8-2 for Grain and Vegetable	2-8-2	Rockville
21381	New England Potato Phosphate 4-8-7 for Potatoes and Vegetables	4-8-7	Rockville

[1] See Table XV, p. 55.
[2] See Note, p. 56.

Containing Nitrogen, Phosphoric Acid and Potash—*Continued.*

Dealer's cash price per ton.	Nitrogen. In nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
	%	%	%	%	%	%	%	%	%	%	%	
$68.00	2.07	0.54	0.92	1.72	5.25	**6.38**	0.48	5.53	**5.05**	1.62	**8.08**	**21096**
40.00	0.84	0.32	0.27	0.84	2.27	**2.76**	1.48	10.53	**9.05**	1.98	**3.02**	**21097**
.....	1.41	0.16	1.08	2.06	4.71	**5.73**	0.78	6.33	**5.55**	0.96	**5.57**	**21387**
46.00	2.02	0.48	0.61	1.06	4.17	**5.07**	0.85	8.58	**7.73**	2.58	**5.28**	**21102**
38.00	0.78	0.44	0.29	0.99	2.50	**3.04**	1.10	8.85	**7.75**	3.54	**4.15**	**21385**
34.00	0.05	0.28	0.40	1.23	1.96	**2.38**	2.05	**10.18**	**8.13**	2.00	**2.00**	**21390**
41.80	1.88	0.48	0.30	0.99	3.65	**4.44**	2.03	9.30	**7.27**	0.74	**4.56**	**21384**
45.00	1.77	0.41	0.46	1.02	3.66	**4.45**	1.15	9.78	**8.63**	2.59	**5.17**	**21095**
50.00	0.15	0.28	0.38	0.57	1.38	**1.68**	1.83	6.70	**4.87**	1.30	**10.85**	**21380**
.....	0.06	0.26	0.37	0.63	1.32	**1.61**	1.20	7.00	**5.80**	1.18	**12.86**	**21548**
73.00	3.53	0.55	1.21	1.58	6.87	**8.35**	1.38	5.05	**3.67**	1.40	**11.51**	**20959**
45.00	**1.97**	0.44	0.49	0.81	3.71	**4.51**	0.73	7.93	**7.20**	0.70	**0.97**	**20960**
42.75	2.24	0.56	0.57	0.94	4.31	**5.24**	2.30	8.19	**5.89**	0.86	**1.20**	**21268**
.....	5.21	0.40	1.09	0.72	7.42	**9.02**	0.65	6.08	**5.43**	2.62	**2.62**	**21553**
59.85	5.11	0.41	1.20	1.07	7.79	**9.47**	1.05	6.83	**5.78**	3.35	**3.35**	**21103**
39.00	0.87	0.03	0.70	0.44	2.04	**2.48**	2.52	10.49	**7.97**	2.46	**2.46**	**21544**
45.00	1.86	0.06	0.62	0.40	2.94	**3.57**	2.06	9.58	**7.52**	3.28	**3.28**	**21543**
48.00	2.38	0.08	0.64	0.38	3.48	**4.23**	1.78	9.88	**8.10**	3.91	**3.91**	**21542**
54.00	3.20	0.06	0.74	0.28	4.28	**5.20**	2.10	10.02	**7.92**	6.95	**6.95**	**21541**
.....	.....	.....	.....	.....	0.87	**1.06**	1.98	2.46	**0.48**	2.56	**2.56**	**21403**
37.00	1.01	0.12	0.33	0.72	2.18	**2.65**	0.60	9.50	**8.90**	3.59	**3.59**	**21386**
49.00	0.82	0.90	0.59	0.99	3.30	**4.01**	0.65	9.00	**8.35**	4.08	**4.08**	**21391**
44.00	0.72	0.10	0.29	0.61	1.72	**2.09**	0.63	9.45	**8.82**	2.41	**2.41**	**21382**
54.00	1.06	0.92	0.32	1.00	3.30	**4.01**	0.78	9.10	**8.32**	6.27	**6.27**	**21381**

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	New England Fertilizer Co., Boston, Mass.—*Continued.*		
21383	New England Superphosphate 3-8-4, for all crops	3-8-4	Rockville
21547	New England Tobacco Manure, 5-8-6	5-8-6	Glastonbury
21389	New England Tobacco, 5-4-5 for Tobacco, Fruits and Vines	5-4-5	West Suffield
	Nitrate Agencies Co., New York.		
21388	Naco Brand No. 12 Peruvian Guano Mixture	5.25-10.5-5.25	Stamford
21716	Naco Brand Peruvian Guano	12-10-2.5	Suffield
	Olds & Whipple, Inc., Hartford.		
21393	Complete Corn, Potato and Onion Fertilizer	4-8-4	New Britain
21398	Complete Corn, Onion and Potato Fertilizer	3-8-2	Suffield
21395	Complete Tobacco Fertilizer	5-3-5	South Windsor
21399	Fish and Potash	3-6-5	South Windsor
21419	High Grade Potato Fertilizer	5-8-7	New Britain
21394	High Grade Starter and Potash Compound	5-4-15	Factory
	Parmenter & Polsey Fertilizer Co., Boston, Mass.		
21429	4-8-4 for Potatoes, Corn and Vegetables	4-8-4	New Britain
21424	Plymouth Rock Brand 3-8-4 for all Crops	3-8-4	Gaylordsville
	Frank S. Platt Co., New Haven		
21420[1]	Platco Special, 4-8-6	4-8-6	Factory

[1] See Table XV, p. 55.

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

Dealer's cash price per ton.	Nitrogen. In nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
	%	%	%	%	%	%	%	%	%	%	%	
$48.00	0.76	0.82	0.21	0.66	2.45	**2.98**	0.40	8.78	**8.38**	3.88	**3.88**	**21383**
.....	1.85	0.18	0.73	1.34	4.10	**4.98**	0.60	9.01	**8.41**	1.34	**6.33**	**21547**
54.00	1.25	0.28	1.49	1.19	4.21	**5.12**	1.00	5.75	**4.75**	0.64	**5.30**	**21389**
.....	1.08	1.90	0.46	0.71	4.15	**5.05**	0.93	11.70	**10.77**	5.33	**5.66**	**21388**
80.00	1.14	4.38	0.49	5.00	11.01	**13.39**	1.71	12.00	**10.29**	2.42	**2.83**	**21716**
43.70	1.56	0.07	0.21	1.52	3.36	**4.09**	1.45	9.60	**8.15**	4.30	**4.30**	**21393**
39.42	1.54	0.02	0.08	1.12	2.76	**3.36**	1.20	9.65	**8.45**	1.17	**2.31**	**21398**
55.57	0.98	0.06	0.19	3.09	4.32	**5.25**	0.25	4.05	**3.80**	0.77	**5.95**	**21395**
42.75	1.01	0.14	none	1.54	2.69	**3.27**	0.60	7.88	**7.28**	5.39	**5.39**	**21399**
55.35	1.43	0.23	1.10	1.75	4.51	**5.48**	2.25	10.30	**8.05**	3.80	**7.61**	**21419**
61.75	1.46	0.06	0.51	2.10	4.13	**5.02**	0.25	4.50	**4.25**	1.93	**16.00**	**21394**
44.00	1.08	0.86	0.54	0.73	3.21	**3.90**	0.80	9.10	**8.30**	4.20	**4.20**	**21429**
39.75	0.93	0.11	0.54	0.90	2.48	**3.02**	0.68	9.40	**8.72**	3.74	**3.74**	**21424**
47.00	1.05	0.71	0.60	0.61	2.97	**3.61**	0.99	8.83	**7.84**	6.27	**6.27**	**21420**

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	The Rogers & Hubbard Co., Portland.		
21454	R. & H. All Soils-All Crops	4-8-4	Hartford
21421	Hubbard's "Bone Base" Fertilizer for Oats and Top Dressing	*10-3-8*	*Glastonbury*
21422	Hubbard's "Bone Base" Fertilizer for Seeding Down	3-5-6	Factory
21457[1]	Hubbard's "Bone Base" Soluble Corn and General Crops Manure	3-8-6	Norwich
21460	Hubbard's "Bone Base" Soluble Potato Manure	6-8-5	Norwich
21464	R. & H. Climax Tobacco Brand	5-4-4	Glastonbury
21459	R. & H. Corn and Grain Fertilizer	1-10-3	Norwich
21467	R. & H. Garden Fertilizer	2-8-4	Hartford
21462	R. & H. High Potash Fertilizer	3-8-10	Somers
21458	R. & H. Potato Fertilizer	2-8-4	Norwich
21456	R. &. H. Tobacco Grower, Vegetable Formula	6-4-4	Windsor
21465	R. & H. Soluble Tobacco Manure	6-8-10	Somerville
	F. S. Royster Guano Co., Baltimore, Md.		
21471	Royster's Bully Guano	2-8-5	Glastonbury
21477	Royster's Fish, Flesh and Fowl	2-8-3	Danielson
21469[1]	Royster's Quality Trucker	4-8-7	Glastonbury
21476[1]	Royster's Top Dresser	7-6-5	Glastonbury
20905	Royster's Trucker's Delight	4-8-4	Milford
21468	Royster's Valley Tobacco Formula	5-4-5	Glastonbury
	Sanderson Fertilizer & Chemical Co., New Haven.		
21070	Atlantic Coast Bone, Fish and Potash	2-8-3	Warehouse Point
21069	Complete Tobacco Grower	5-4-5	Warehouse Point
21472	Corn Superphosphate	2-8-2	Seymour
21139	Formula A	4-8-4	Guilford
21475	Formula B	4-8-6	Cromwell
21486[1]	Kelsey's Bone, Fish and Potash	3-10-3	North Haven
21484	Potato Manure	3-8-4	West Cheshire
21489	Top Dressing for Grass and Grain	6-6-4	East Haven

[1] See Table XV, p. 55.

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

Dealer's cash price per ton.	Nitrogen. In nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
	%	%	%	%	%	%	%	%	%	%	%	
$54.00	2.22	0.16	0.54	0.46	3.38	**4.11**	2.29	9.85	**7.56**	3.91	**3.91**	**21454**
.....	6.83	0.03	0.90	0.35	8.11	**9.86**	3.80	8.15	**4.35**	3.40	**7.10**	**21421**
49.25	1.08	0.13	0.38	1.15	2.74	**3.33**	5.30	12.30	**7.00**	5.49	**5.49**	**21422**
51.00	1.13	0.16	0.52	0.66	2.47	**3.00**	3.63	11.63	**8.00**	5.08	**5.08**	**21457**
64.00	3.17	0.15	0.92	0.76	5.00	**6.08**	2.94	9.99	**7.05**	1.14	**5.49**	**21460**
54.00	1.43	0.05	0.46	1.92	3.86	**4.69**	0.85	5.20	**4.35**	0.61	**4.48**	**21464**
38.00	none	0.13	0.24	0.56	0.93	**1.13**	2.03	12.60	**10.57**	2.57	**2.57**	**21459**
47.00	0.49	0.17	0.56	0.52	1.74	**2.11**	2.23	10.17	**7.94**	3.37	**3.37**	**21467**
46.00	1.33	0.09	0.63	0.48	2.53	**3.08**	2.87	10.76	**7.89**	9.73	**9.73**	**21462**
42.00	0.60	0.12	0.56	0.34	1.62	**1.97**	2.01	9.89	**7.88**	3.66	**3.66**	**21458**
.....	1.46	0.08	0.12	3.32	4.98	**6.05**	1.08	5.50	**4.42**	0.57	**4.10**	**21456**
61.00	3.47	0.15	1.23	0.67	5.52	**6.71**	2.19	9.70	**7.51**	1.48	**10.11**	**21465**
.....	0.11	1.22	none	0.41	1.74	**2.11**	0.75	9.13	**8.38**	4.97	**4.97**	**21471**
36.75	0.08	1.02	none	0.45	1.55	**1.88**	1.27	9.03	**7.76**	3.31	**3.31**	**21477**
.....	0.08	2.08	0.24	0.65	3.05	**3.71**	1.08	9.15	**8.07**	6.90	**6.90**	**21469**
.....	0.78	2.82	0.46	1.25	5.31	**6.46**	0.77	6.68	**5.91**	4.86	**4.86**	**21476**
43.00	0.10	2.22	0.23	0.64	3.19	**3.88**	0.90	8.87	**7.97**	3.91	**3.91**	**20905**
57.25	0.45	0.94	0.08	2.40	3.87	**4.71**	0.40	4.98	**4.58**	0.49	**4.95**	**21468**
35.00	0.04	0.58	0.42	0.64	1.68	**2.04**	1.15	9.48	**8.33**	3.02	**3.02**	**21070**
54.75	0.87	0.15	0.19	2.98	4.19	**5.09**	0.28	4.58	**4.30**	0.61	**4.95**	**21069**
38.00	0.12	0.50	0.34	0.66	1.62	**1.97**	0.90	9.10	**8.20**	2.15	**2.15**	**21472**
48.00	0.64	1.37	0.60	0.66	3.27	**3.98**	1.23	9.33	**8.10**	4.02	**4.02**	**21139**
45.00	0.76	1.00	0.32	1.42	3.50	**4.26**	1.69	9.77	**8.08**	2.68	**5.98**	**21475**
.....	0.36	0.74	0.43	0.73	2.26	**2.75**	0.88	10.87	**9.99**	3.05	**3.05**	**21486**
45.00	0.42	0.90	0.34	0.78	2.44	**2.97**	0.68	8.80	**8.12**	4.17	**4.17**	**21484**
49.00	2.85	1.18	0.33	0.64	5.00	**6.08**	0.98	7.00	**6.02**	3.82	**3.82**	**21489**

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station: **M. L. Shoemaker & Co., Philadelphia, Pa.**		
21488	Swift-Sure Cotton Seed Mixture, 5-4-5	5-4-5	New Milford
21491	Swift-Sure Super Phosphate Crop Grower, 4-8-4	4-8-4	Hartford
21487	Swift-Sure Super Phosphate Potato No. 1, 4-8-5	4-8-5	New Milford
21136	Swift-Sure Super Phosphate Tobacco and General Use, 3-10-3	3-10-3	Thompsonville
	Springfield Rendering Co., Springfield, Mass.		
21492[1]	4-8-6	4-8-6	Suffield
21135	Animal Brand, 3-8-4	3-8-4	Windsor Locks
21142	Market Garden Grower and Top Dresser, 5-8-7	5-8-7	Stafford Springs
21485[1]	Special Potato, Onion and Vegetable, 4-8-4	4-8-4	Stafford Springs
21530	Tobacco Special, 5-4-5	5-4-5	Windsor Locks
	Virginia-Carolina Chemical Co., New York.		
21496	Aroostook Potato Grower	5-8-7	North Haven
21138	Champion Brand	4-8-4	Rockville
21140	Double Owl Brand	4-8-6	Guilford
21495	Eureka Brand	2-8-10	North Haven
21141[1]	Fish, Phosphate and Potash Brand	2-8-2	Danielson
21137	Indian Chief Brand	5-4-5	Hazardville
21131	Owl Brand	2-8-3	North Haven
21497	Perfection Brand	3-9-5	North Haven
21504	Plymouth Brand	2-12-4	New Hartford
	Whitman & Pratt Rendering Co., Boston, Mass.		
21120	Whitman & Pratt's 4-8-4 Brand	4-8-4	Norwich
	Wilcox Fertilizer Co., Mystic.		
21499	4-8-4, Fertilizer	4-8-4	New London
21319[1]	5-8-7	5-8-7	Factory
21115	Corn Special	3-10-4	Mystic
21116	Fish and Potash	3-8-3	Mystic
21501[1]	Grass and Truck Fertilizer	5-8-4	Factory
21500[1]	Potato and Vegetable Phosphate	4-8-6	Mystic
21123	Tobacco Special	5-4-5	Ellington

[1] See Table XV, p. 55.

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

Dealer's cash price per ton.	Nitrogen.					Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Potash.		Station No.
	In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Total.		Citrate-insoluble.	Total.	So-called "Available."	As muriate.	Total.	
	%	%	%	%	%	%	%	%	%	%	%	
$60.00	0.72	0.11	0.14	3.39	4.36	5.30	2.03	8.40	6.37	1.63	6.26	21488
.....	1.17	0.11	0.28	1.50	3.06	3.72	0.95	12.13	11.18	2.68	3.54	21491
48.00	1.15	0.09	0.45	1.67	3.36	4.09	3.40	12.78	9.38	0.54	5.39	21487
52.00	1.16	0.04	0.34	1.38	2.92	3.55	2.60	13.38	10.78	0.51	3.33	21136
45.25	0.56	0.70	0.72	1.02	3.00	3.65	0.65	9.13	8.48	6.02	6.02	21492
45.00	1.14	none	0.60	0.75	2.49	3.03	0.38	8.88	8.50	4.13	4.13	21135
50.00	1.48	0.05	1.30	1.33	4.16	5.06	0.60	9.18	8.58	7.16	7.16	21142
44.00	1.43	0.05	0.79	0.78	3.05	3.71	0.55	9.03	8.48	4.04	4.04	21485
.....	1.48	0.06	0.58	1.80	3.92	4.77	0.28	5.38	5.10	0.80	5.43	21530
49.00	0.08	3.69	0.07	0.25	4.09	4.97	0.93	9.53	8.60	7.14	7.14	21496
50.00	0.11	2.57	0.29	0.30	3.27	3.98	1.30	9.35	8.05	4.04	4.04	21138
40.75	0.12	2.70	0.15	0.21	3.18	3.87	1.40	10.53	9.13	6.04	6.04	21140
40.00	none	1.21	0.14	0.23	1.58	1.92	1.10	9.23	8.13	9.97	9.97	21495
31.00	0.04	0.66	0.43	0.31	1.44	1.75	1.68	9.95	8.27	1.90	1.90	21141
54.25	0.43	0.46	none	3.29	4.18	5.08	0.55	5.25	4.70	0.53	4.89	21137
35.00	0.03	1.18	0.33	0.16	1.70	2.07	1.55	10.59	9.04	3.17	3.17	21131
41.00	0.02	2.10	0.26	0.22	2.60	3.16	1.45	10.78	9.33	4.92	4.92	21497
35.00	0.07	1.29	0.04	0.18	1.58	1.92	1.35	13.88	12.53	4.22	4.22	21504
40.00	1.30	0.18	0.11	1.69	3.28	3.99	5.43	14.63	9.20	4.06	4.06	21120
45.00	1.45	0.30	0.53	0.87	3.15	3.83	2.05	10.15	8.10	4.00	4.00	21499
.....	1.94	0.08	0.88	1.09	3.99	4.85	2.08	10.08	8.00	3.38	6.80	21319
39.00	1.23	0.09	0.48	0.74	2.54	3.09	1.50	11.28	9.78	4.26	4.26	21115
38.50	0.68	0.14	0.35	1.23	2.40	2.92	0.78	8.78	8.00	3.31	3.31	21116
.....	1.81	0.09	0.83	1.21	3.94	4.79	2.33	10.34	8.01	3.43	4.03	21501
44.90	1.66	0.01	0.60	0.82	3.09	3.76	1.63	10.05	8.42	2.14	5.79	21500
60:00	0.74	0.10	0.16	2.96	3.96	4.81	0.40	6.23	5.83	0.61	6.40	21123

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	S. D. Woodruff & Sons, Orange.		
21503[1]	Woodruff's Home Mixed..........	4-8-6	Factory............
	Worcester Rendering Co., Auburn, Mass.		
21122	Prosperity Brand Corn and Grain..	2-8-2	Putnam............
21506[1]	Prosperity Brand Potato and Vegetable Fertilizer............	4-8-4	Norwich...........
	Sampled by Purchaser:		
	American Chemical Specialties Co., Inc., New Jersey.		
20431	Springfield Carnation Food.......	2.4-3.25 -3.5	Jewett City.........
	Bowker Fertilizer Co., New York.		
20949	Bowker's Tobacco Fertilizer.......	5-4-5	Suffield............
21587	Stockbridge Tobacco Fertilizer, 5-4-5	5-4-5	Suffield............
	Eastern States Farmers' Exchange, Springfield, Mass.		
21347	7-8-3.........................	7-8-3	Milford............
21348	5-8-7.........................	5-8-7	Milford............
	The L. T. Frisbie Co., New Haven.		
21220	4-8-6 Fertilizer..................	4-8-6	Woodmont.........
21221	5-10-5 Fertilizer.................	5-10-5	Woodmont.........
	Mapes Fertilizer and Peruvian Guano Co., New York.		
20948	Potato Manure...................	4-7-5	Suffield............
	Nitrate Agencies Co., New Jersey.		
20629	Genuine Peruvian Guano..........	12-10-2.5	Suffield............

[1] See Table XV, p. 55.
[2] $4.80 per one hundred pounds.

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Concluded.*

Dealer's cash price per ton.	Nitrogen.					Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Potash.		Station No.
	In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Total.		Citrate-insoluble.	Total.	So-called "Available."	As muriate.	Total.	
	%	%	%	%	%	%	%	%	%	%	%	
$42.00	1.42	0.02	0.63	1.49	3.56	4.33	11.19	13.14	1.95	6.38	6.38	21503
34.50	1.02	0.06	0.30	0.46	1.84	2.24	0.17	8.33	8.16	2.32	2.32	21122
45.00	0.63	0.61	0.37	0.91	2.52	3.06	1.05	9.15	8.10	5.08	5.08	21506
.....	....	....	....	.....	2.16	2.63	2.88	8.84	5.96	....	3.85	20431
.....	....	....	....	.....	4.29	5.22	....	5.00	....	....	5.50	20949
60.25	....	....	....	.....	4.19	5.09	0.31	4.63	4.32	....	5.02	21587
[2]	....	....	....	.....	5.32	6.47	0.70	9.15	8.45	....	2.99	21347
[2]	....	....	....	.....	3.99	4.85	0.68	9.30	8.62	....	6.53	21348
41.00	....	....	....	.....	3.16	3.84	1.03	9.33	8.30	6.70	6.70	21220
46.00	....	....	....	.....	3.97	4.83	0.18	10.65	10.47	5.08	5.08	21221
.....	....	....	....	.....	2.43	2.95	....	9.45	....	....	4.07	20948
75.00	....	4.35	....	.....	15.00	18.24	0.15	9.54	9.39	....	2.01	20629

SPECIAL MIXTURES AND HOME MIXTURES.

In Table XIX are given analyses of special mixtures prepared by manufacturers according to specifications furnished by the purchasers and also of home mixtures prepared by individuals or firms from raw materials purchased by them. Twenty-six samples of these types were analyzed. Ten of these were sampled by the Station agent and the remainder were submitted by the consumers.

In some cases formulas were submitted with the samples and they are given in Table XVII.

TABLE XVII. FORMULAS FOR SOME OF THE MIXTURES GIVEN IN TABLE XIX.

Station No.	Cottonseed meal.	Castor pomace.	Fish.	Tankage.	Nitrate of soda.	Sulphate of ammonia.	Bone.	H. G. Sulphate of potash.	Muriate of potash.	Acid phosphate.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
20169	700	300	300	...	200	...	300	200	...	...
20170	700	300	300	...	200	...	300	200	...	...
21327	500	500	300	...	200	...	300	200	...	...
21326	500	500	300	...	200	...	300	200	...	...
21379	500	500	500	...	...	...	200	300	...	...
20955	...	...	...	750	100	...	...	200	200	750
21330	...	...	1000	...	200	200	...	600	...	...

VII. MISCELLANEOUS FERTILIZERS, AMENDMENTS, WASTE PRODUCTS, ETC.

WOOD ASHES, ETC.

Sixteen samples have been examined.

The following were submitted by Hatheway & Steane, Hartford; purchased from John Joynt, Lucknow, Canada.:

20963, car No. 89524; **20964,** car No. 30111; **20965,** car No. 43297; **21233,** car No. 8098; **21234,** car No. 1542; **21522,** car No. 35078; **21744,** car No. 108196.

Other samples were:

21010. Sent by Amos D. Bridges' Sons, Inc., Hazardville. Bought of the Ross Brothers Company of Worcester, Mass.

21529. Station agent from F. T. Blish Hardware Co., South Manchester. Bought of John Joynt, Lucknow, Canada.

20892. Sent by A. N. Farnham, New Haven.

20497, 21800, 21801. Sent by A. N. Shepard & Son, Hartford. Bought of John Joynt, Lucknow, Canada.

21003. Sent by H. Whitaker, Hazardville. Bought of John Joynt, Lucknow, Canada.

19954. Canadian wood ashes, sent by Steane, Hartman & Co., Hartford.

19807. Sent by Stamford Dyewood Co., Stamford.

TABLE XVIII. ANALYSES OF WOOD ASHES, ETC.

Station No.	Phosphoric acid.	Water-soluble potash.	Insoluble material.	Cost per ton or per unit of potash.
	%	%	%	
20963	2.35	6.74	11.11	$5.00
20964	2.35	6.83	9.13	5.00
20965	2.25	6.38	12.73	5.00
21233	2.35	6.36	15.18	.....
21234	2.50	6.67	18.32	.....
21522	2.53	6.39	13.09	.....
21744	2.17	6.75	9.17	33.33
21010	1.38	2.73	16.84	23.00
21529	1.18	2.05	12.63	27.50
20892	3.07	7.19	18.45	.....
20497	1.85	5.31	12.50	.....
21800	1.68	7.34	8.10	.....
21801	1.68	6.13	16.13	.....
21003	2.10	6.53	12.20	.....
19954	2.28	4.12	7.15	.....
19807[1]	1.47	0.03	5.20	.....

Samples **21010** and **21529** were of inferior quality. Sample **19807** was submitted as "wood ashes". It was, however, a waste product, in the form of a slag or clinker, consisting chiefly of lime.

SHEEP MANURE, ETC.

Analyses of seven samples of sheep manure and one of poultry manure are given in Table XX. All were sampled by the Station agent.

21148. Sold by American Agricultural Chemical Co., N. Y. Sampled from stock of Bristol Grain & Supply Co., Bristol.

21283. Sold by Armour Fertilizer Works, N. Y. Sampled from stock of Rockville Grain & Coal Co., Rockville.

21174. Sold by Berkshire Fertilizer Co., Bridgeport. Sampled at the factory.

20911. Sold by Natural Guano Co., Aurora, Ill. Sampled from stock of Cheshire Reformatory, Cheshire.

21418. Sold by Pacific Manure & Fertilizer Co., Chicago, Ill. Sampled from stock of Lightbourn & Pond Co., New Haven.

20957. Sold by Pulverized Manure Co., Chicago, Ill. Sampled from stock of S. P. Strople, New Britain.

21482. Sold by Sanderson Fertilizer & Chemical Co., New Haven. Sampled at the factory.

21423. Sold by Premier Poultry Manure Co., Chicago, Ill. Sampled from the stock of Plumbing and Supply Co., South Manchester.

---

[1] Lime (CaO) 81.99 per cent.

TABLE XIX. ANALYSES OF SPECIAL MIXTURES

Station No.	Manufacturer.	Grade.	Place of Sampling.
	Sampled by Station:		
20169	American Agricultural Chemical Co., New York..............	.....	Arthur Manning, So. Manch
20170	American Agricultural Chemical Co., New York..............	.....	Arthur Manning, So. Manch
21327	American Agricultural Chemical Co., New York..............	.....	Arthur Manning, So. Manch
20955	Apothecaries Hall Co., Waterbury	.....	Conn. School for Boys, Meri
21110	Olds & Whipple, Inc., Hartford..	.....	Allied Tobacco Co., Hartfor
21111	Olds & Whipple, Inc., Hartford..	.....	Allied Tobacco Co., Hartfor
21546	Olds & Whipple, Inc., Hartford..	.....	G. H. Carrier, Glastonbury.
21326	Olds & Whipple, Inc., Hartford..	.....	Arthur Manning, So. Manch
21379	Olds & Whipple, Inc., Hartford..	.....	C. M. Hickey, East Hartfor
21109	Olds & Whipple, Inc., Hartford..	.....	L. W. Newberry, So. Winds
	Sampled by Purchaser:		
21330	L. T. Frisbie Co., New Haven...	.....	F. L. Porter, So. Windsor..
21000	National Fertilizer Co., Boston..	7-3-7	H. Whitaker, Hazardville...
21001	Olds & Whipple, Inc., Hartford..	6.8-3.2-6.4	H. Whitaker, Hazardville...
21248	Olds & Whipple, Inc., Hartford..	6.2-6-5	Harold M. Newberry, E Windsor Hill............
21249	Olds & Whipple, Inc., Hartford..	6.2-6-5	Harold M. Newberry, E Windsor Hill............
21333	Olds & Whipple, Inc., Hartford..	6.2-6-5	Harold M. Newberry, E Windsor Hill............
21331	Olds & Whipple, Inc., Hartford..	7.6-6.5-7.8	Harold M. Newberry, E Windsor Hill............
21332	Olds & Whipple, Inc., Hartford..	7.6-6.1-7.8	Harold M. Newberry, E Windsor Hill............
21002	The Rogers & Hubbard Co., Middletown...............	6-4-4	H. Whitaker, Hazardville...
20647	....	.....	American Sumatra Tobacco Bloomfield..............
20659	....	.....	American Sumatra Tobacco Bloomfield..............
20660	....	.....	American Sumatra Tobacco Bloomfield..............
20661	....	.....	American Sumatra Tobacco Bloomfield..............
20735	....	.....	American Sumatra Tobacco Bloomfield..............
20736	....	.....	American Sumatra Tobacco Bloomfield..............
21567	....	.....	Ernest N. Austin, Suffield..

AND HOME MIXTURES.

Nitrogen.				Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Potash.		Station No.
In ammonia.	Organic, Water-soluble.	Organic, Water-insoluble.	Total.		Citrate-insoluble.	Total.	So-called "Available."	As muriate.	Total.	
%	%	%	%	%	%	%	%	%	%	
....	....	....	5.78	7.03	....	5.30	....	0.39	6.17	20169
....	....	....	5.86	7.12	....	4.99	....	1.67	6.39	20170
0.14	4.29		6.06	7.37	1.85	6.80	4.95	1.09	6.29	21327
....	....	....	4.00	4.86	....	7.45	....	8.67	10.37	20955
0.10	4.15		5.57	6.77	1.25	6.65	5.40	0.85	6.18	21110
0.08	4.15		5.51	6.70	1.15	6.63	5.48	1.16	5.77	21111
2.03	0.53	1.74	5.68	6.91	1.03	8.28	7.25	1.57	8.04	21546
0.08	4.55		6.17	7.50	1.18	5.95	4.77	0.66	5.86	21326
....	....	....	4.72	5.74	0.48	8.80	8.32	0.96	8.41	21379
0.07	3.78		5.60	6.81	0.35	6.65	6.30	1.40	8.20	21109
....	....	....	7.34	8.92	0.35	3.93	3.58	1.34	13.74	21330
0.13	5.06		6.14	7.47	0.28	4.00	3.72	0.90	6.93	21000
0.88	4.68		5.66	6.88	0.20	3.83	3.63	0.74	6.67	21001
1.14	3.92		5.14	6.25	0.20	6.23	6.03	0.76	7.59	21248
1.17	4.02		5.36	6.52	0.30	6.38	6.08	0.78	6.44	21249
....	....	....	5.00	6.08	0.23	6.68	6.45	2.23	6.25	21333
....	....	....	6.00	7.29	1.53	7.10	5.57	0.93	7.85	21331
....	....	....	4.63	5.63	0.30	7.05	6.75	0.97	8.58	21332
0.09	3.64		5.20	6.32	1.00	5.28	4.28	0.69	4.08	21002
....	....	....	5.54	6.74	....	5.40	....	0.32	7.86	20647
0.07	....	....	5.56	6.76	....	5.27	....	0.27	5.22	20659
0.07	....	....	5.52	6.71	....	6.01	....	0.28	6.77	20660
0.11	....	....	5.90	7.17	....	4.77	....	0.27	5.56	20661
....	....	....	5.73	6.97	....	6.50	....	0.25	8.76	20735
....	....	....	4.61	5.60	....	6.14	....	1.48	8.85	20736
....	....	....	7.24	8.80	0.53	4.10	3.57	1.97	9.56	21567

TABLE XX. ANALYSES OF SHEEP MANURE, ETC.

Station Number	**21148**	**21283**	**21[illegible]74**	**20911**	**21418**	**20957**	**21482**	**2**
	%	%	%	%	%	%	%	
Nitrogen in nitrates		0.07	......	0.06	......	......	......	
" in ammonia		0.12	......	0.20	......	......	0.06	
" organic		1.31	......	2.28	......	......	1.22	
" total found	2.43	1.50	2.25	2.54	1.48	2.08	1.28	
" guaranteed	2.06	1.23	1.80	2.25	1.50	2.00	1.23	
Phosphoric acid, citrate-insoluble	......	......	0.15	0.15	......	0.08	.....	
" " total found	1.65	0.80	1.25	1.43	0.90	1.55	1.00	
" " guaranteed	1.25	1.00	......	1.25	0.75	.....	1.00	
Potash, water-soluble, found	2.08	2.99	2.08	2.13	2.84	2.13	2.71	
" " guaranteed	1.00	2.50	2.00	2.00	3.00	2.00	2.50	
Cost per ton	$45.00	$50.00	$45.00	$40.00	$49.00	$50.00	......	$5

POTASH-MARL.

21426. One sample of Potash-Marl manufactured by the Potash-Marl, Inc., New York, was taken by the station agent from the stock of Lightbourn & Pond Co., New Haven.

This is prepared from green sand marl and may contain six per cent or more of potash not, however, in water-soluble form. Only phosphoric acid, of which it contains an inconsiderable amount, is guaranteed by the manufacturer.

The analysis is as follows:

Station No.	**21426**
	%
Available phosphoric acid, found	0.47
guaranteed	0.24
Total phosphoric acid, found	1.30
guaranteed	0.88
Price per ton	$45.00

LIMESTONE, ETC.

Three samples of lime-bearing materials were submitted for analysis.

21126. Ground limestone, submitted by C. R. Treat, Orange.

20668. Unground rock, submitted by Edson Cogswell, New Preston.

20545. Hydrated lime, submitted by Dwight Coles, Salisbury.

Analyses are as follows:

Station No.	**21126**	**20668**	**20545**
	%	%	%
Lime (CaO)	32.76	24.73	62.25
Magnesia (MgO)	12.10	.....	0.85
Insoluble in acid	13.88	2.29	0.94

In case of sample **21126**, 98 per cent passed a 20 mesh sieve, 85 per cent passed 40 mesh and 80 per cent passed 50 mesh.

PEAT OR MUCK.

Four samples of this material were submitted.

20091. Natural humus, dried, submitted by Bertolf Bros., Sound Beach.

20611. "Radio-active Peat" submitted by A. A. Young, Jewett City. It is claimed that the radio-activity of the product is the stimulus for the increased growth of plants.

21596, Subsoil and **21597,** top soil, submitted by Elm City Nursery, New Haven.

Analyses are as follows:

Station No.	20091		20611		21596		21597	
	As rec'd %	Dry basis %	As rec'd %	Dry basis %	As rec'd %	Dry basis %	As rec'd %	Dry basis %
Water	22.40	.....	41.30	.....	78.00	.....	70.00	.....
Ash	48.98	63.08	33.70	57.40	2.68	12.17	1.62	5.39
Organic and volatile	28.62	36.92	25.00	42.60	19.32	87.83	28.38	94.61
Nitrogen	1.02[1]	1.32	.....	.....	0.37	1.70	0.53	1.75

These materials particularly **21596** and **21597,** should be valuable as absorbents and for composting with manure; the economy of their use will depend, of course, upon the cost of handling.

We can give no opinion on the merits of **20611** from the standpoint of radio-activity.

SEWAGE SLUDGE.

Two samples of dried sewage sludge have been examined.

20612. Product of the sewage disposal plant in Stratford, submitted by R. H. Hunter.

21802. Product of the East Port Chester sewage disposal plant, submitted by Albert S. Mead, Greenwich.

Analyses are as follows:

Station No.	20612 %	21802 %
Moisture	2.56	....
Ash	64.92	55.55
Nitrogen, in ammonia	0.06	0.02
organic, water-soluble	....	0.22
organic, water-insoluble	....	1.66[1]
total	1.74	1.90
Phosphoric acid, "available"	....	0.47
total	1.04	0.60
Potash, total	....	0.27

[1]About 60 per cent in so-called "active" form.

In general, the fertilizer ingredients, i.e., nitrogen, phosphoric acid and potash, in this kind of material are inconsiderable. Its chief usefulness is when applied to light, sandy soils which will be benefited by the humus which it contains.

MISCELLANEOUS MATERIALS.

Soils.

Nineteen samples have been submitted. Tests were made for acidity and lime requirement but no further examinations were undertaken. The diagnosis of soil troubles is a difficult and uncertain task not to be solved by the usual chemical analysis.

Check Cottonseed Meals.

Thirty samples, chiefly cottonseed meals, were examined and reported to the American Oil Chemists' Society in connection with their cooperative program in which this laboratory has participated. The schedule involves the analysis of weekly samples sent out by the Society to various control and industrial laboratories for the purpose of studying uniformity of methods and technique in the analysis of this class of products.

Check Fertilizers.

Eleven samples of mixed fertilizers have been analyzed and reported to the Royster Guano Co. The plan and purpose of this cooperative work is similar to that already explained for the Check Meal series.

Unclassified.

Seven samples of miscellaneous materials have been examined which require no particular comment.

BULLETIN 251 DECEMBER, 1923

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

The Raspberry Fruit Worm

BY B. H. WALDEN.

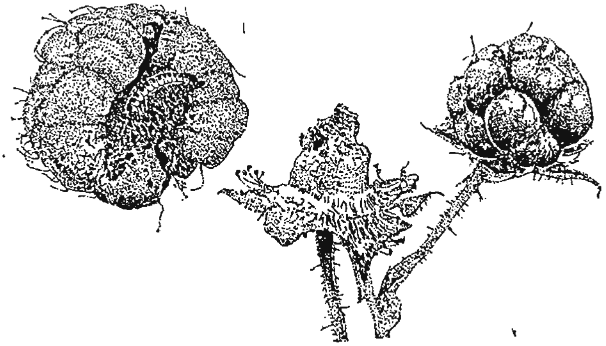

Figure 1. Infested Raspberry.

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The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

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December, 1923.

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The Raspberry Fruit Worm.

Byturus unicolor Say

By B. H. Walden, B.Agr.

Though the Raspberry Fruit Worm or Raspberry Beetle has long been known as a pest of red raspberries in the United States, very little has been published by economic entomologists regarding its life history or habits.

The first published record of the occurrence of this species in Connecticut was by Lintner,[6] State Entomologist of New York, to whom specimens were submitted for identification from North Haven, May 25, 1891. The species has been represented in our collection since 1902, although few complaints of injury have been received until within the last three or four years.

The insect has apparently been on the increase in the State since the St. Regis everbearing raspberries came into general cultivation. In 1920, Mr. George Hunter, a grower of small fruits in East Haven, reported that his St. Regis raspberries were badly infested with small, whitish worms which upon investigation proved to be the larvae of *Byturus unicolor* Say. From 1921 to 1923 the following observations on the habits and life history of this insect were largely made upon his grounds in East Haven.

History and Distribution.

Byturus unicolor was described in 1823 by Thomas Say[1] from a single specimen collected in Arkansas. It was mentioned by Packard[2] as injuring raspberries at Salem, Massachusetts, in 1869. The most complete early account of the injury and habits of the species observed by the writer was published by Fitch[3] of New York in 1870–1872. Saunders[4] reported injury by this insect in 1873 without mentioning any specific locality, but his observations were undoubtedly made in Ontario. Fletcher[5] records the species definitely from Ontario in 1887. Goodwin[7] of Ohio published in 1909 additional information regarding the habits and life history, together with results of experiments in controlling the insect. Various writers have recorded the species from many parts of the United States. It undoubtedly occurs throughout the southern part of Canada and the United States with the exception of some of the more southern states. Leng[8] gives its range from the Atlantic Coast to Washington and Arizona.

Food Plants and Injury.

In Connecticut this insect has been found attacking the fruit of only the red species of raspberries and it shows a decided preference for certain horticultural varieties. The work of the adults, however, has been observed on the foliage of black cap raspberries and the Columbian or purple raspberry. There are also two records in the notes of the department where this insect has apparently infested the fruit of blackberry. Here again it seems to show preference for certain varieties as in East Haven, where there were two rows of blackberries (variety not known) adjoining the experimental plot of raspberries and no injury was observed either on the foliage or to the fruit. As indicated above, the early fruit of the St. Regis variety is especially subject to attack. A small block of the Victory raspberry in Montowese, the only planting of this recent variety observed, also showed considerable injury by this beetle. The fruit of the Cuthbert, an old standard variety which is considered one of the best commercial varieties of the state, however, has not been found seriously infested. The owner of the Victory raspberries in Montowese has grown the Cuthbert and St. Regis side by side; the latter was so badly infested that the variety was discarded. In North Branford where the two varieties were grown in the same field similar conditions regarding the infestations were observed. Goodwin, in Ohio, found the King variety severely injured while the fruit of the Cuthbert was scarcely attacked, and gives the following as a possible explanation: "The longer and more open bud clusters of the Cuthberts, affording less opportunity for the beetles to feed conveniently, seemed to be the only reasonable explanation for the comparative immunity, because the tender leaves of the latter seemed to be injured fully as much as the King."

Dr. Felt[9] of New York records serious injury to the Perfection variety in the Hudson Valley. The injury was much greater on an exceptionally early patch of this variety than on one where the fruit buds developed a week later, and he states that "the relative earliness of the field may be an important factor in determining the amount of injury."

There are three distinct types of injury caused by the insect.

1. The adults feed on the unfolding leaves, often skeletonizing them. Plate IV, a.
2. As the blossom buds appear the beetles attack these, eating out the inside and when numerous may destroy the whole bud cluster. Plate II, a.
3. The third type of injury is caused by the larvae infesting the fruit. In many cases the larvae develop in and destroy the fleshy receptacle on which the fruit is borne, causing the fruit to dry up before ripening, or they may feed on the carpels which dry up or become infected with a mould which causes the re-

mainder of the berry to decay or become soft. At picking time many of the berries which do not show any exterior injury will each be found to contain a larva which has worked partly on the underside of the fruit and partly in the receptacle. The larvae frequently adhere to the picked fruit, and even with careful sorting it is hard to detect all of them. Plate I, c.

In the East Haven field in 1921, a count of the fruit buds in the most severely infested portion of the field showed that about 37 per cent. of the buds had been injured by the beetles and at the time the fruit was ripening 57.9 per cent. of the berries that developed were infested with the larvae. The owner did not harvest the early fruit of this variety either in 1921 or 1922.

The fall fruit is not attacked by this insect.

Life History and Habits.

The beetles appear in spring soon after the new growth of the plants is well started. In 1921 they were abundant on May 10, at the time of the first visit to the field. In 1922 observations were made from April 19, and the first adults were found on May 8 and were appearing in numbers from May 12 to May 16. The beetles seem to prefer the sunlight and are found on the tips of the plants on bright sunny days. In cold, cloudy weather the beetles are inactive and seek protection under the foliage.

They feed for a number of days before mating and laying eggs. The leaves before opening are folded in more or less of a fan-shaped manner and the beetles feed along the upper surface of the folds, so that when the leaves are fully open they are perforated with a series of elongated holes which parallel the veins. When the beetles are abundant nearly all of the tissue between the veins may be eaten as shown on Plate IV, a. After the blossom buds are formed the beetles attack these, eating out the inside as shown on Plate III, b.

When disturbed the beetles will fly for a short distance but apparently do not spread rapidly in the field. The insects were more abundant towards the south end of the block in 1921 and the same condition, to a somewhat less extent, was true in 1922. A new block of St. Regis raspberries was set about sixty feet from the old one in 1921, and no beetles were found on it that season. In 1922 only five or six adults were seen on the new plants and but a very few larvae were found in the fruit. These were in two rows towards the old field. Low growing crops were planted each year on the intervening space.

By June 5 the majority of the beetles had disappeared, although a few remained longer; the latest date that a beetle was observed in the field was on June 22.

The first eggs were found on May 22, fourteen days after the first adults were observed, although in 1921, three eggs were

found on May 10. The eggs are deposited singly and are quite difficult to find in the field. The position of the eggs on each of a number of tips examined at about the time the first blossom buds opened was as follows:

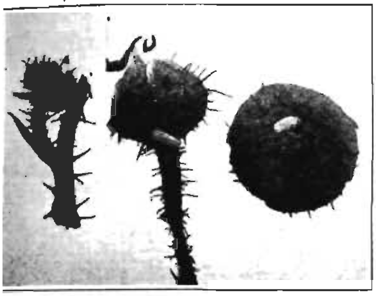
On base of blossom buds	10
In cavity eaten in buds	2
On bud petioles	4
Axil of bud petioles	5
Axil of bud and leaf petioles	2
Axil of leaflet petioles	4
Underside of leaves in fold	5
Total	32

After the blossom buds open, eggs are deposited within the blossom among the filaments of the stamens where they are quite difficult to find as they are about the size of the numerous anthers of the stamens and are concealed by them. It is quite probable that many more of the eggs are laid within the blossoms than observations indicate, as the number of larvae which developed greatly exceeded the number of eggs actually found.

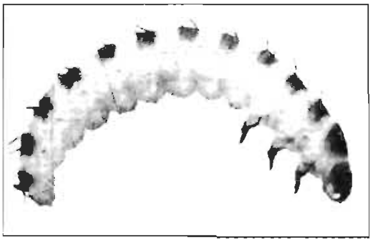
The average length of time between ovipositing and hatching of the egg has not been determined. Newly hatched larvae were found on material collected in the field May 27, or five days after the eggs were first observed. A large series of adults placed in breeding cages in the laboratory failed to deposit eggs. From ten adults caged out of doors, two eggs were obtained, one of which hatched in seven days while the other failed to develop.

Where the eggs are laid on the outside of buds and hatch before the buds open the young larvae eat small holes through the surface and enter the buds to feed (see Plate II, b). These holes have been observed where the eggs had not been laid on the bud, indicating that the larvae had traveled a greater distance than the length of the bud petiole. The young larvae have not been observed feeding on the outside of buds or on the leaves where eggs are occasionally laid; however, they are inconspicuous and the hairs and pubescence of the raspberry foliage offer such ideal conditions for concealment that it is impossible to state definitely without further investigation that the larvae do not feed outside of the buds. The latest date on which an egg was found in the field was on June 29. Full-grown larvae were found on June 16 and a few berries containing larvae were gathered as late as July 18.

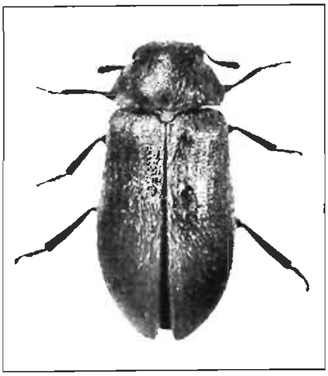
After leaving the berries the larvae drop to the ground and enter the soil forming small circular cavities or pupal cells about three millimeters in diameter. This fact has been noted by Fitch and Goodwin. Fitch also published a brief description of the pupa which appears to be the only one occurring in the literature of the species. Goodwin failed to obtain the pupa and writes as follows: "A few of the larvae formed pupal cells in the soil of



a. Eggs, enlarged four times.



b. Larva (preserved specimen), enlarged eight times.



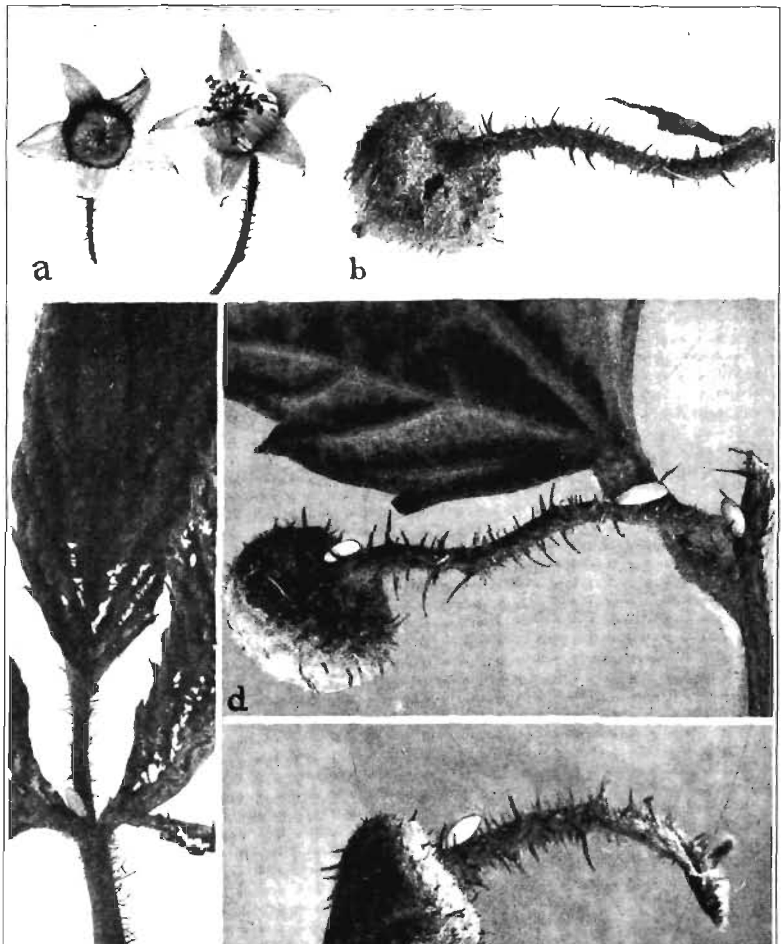
d. Adult, enlarged ten times.

e. Pupa, enlarged eight times.

c. Larvae and injury to fruit, enlarged four times.

RASPBERRY FRUIT WORM.

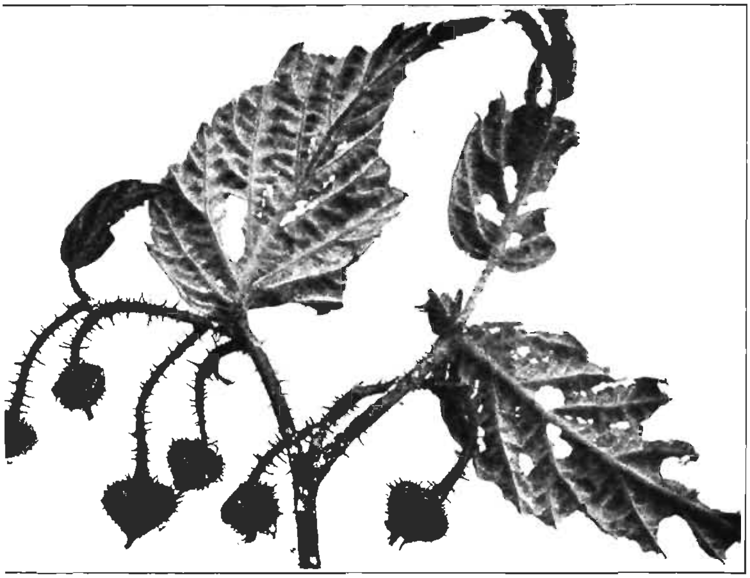
PLATE II.



a. Blossom eaten by beetle at left, normal blossom at right, twice natural size.
b. Egg shell and hole in bud where larva entered, enlarged six times.
c. Egg on leaf petiole, enlarged four times.
d. Three eggs on bud and petiole, enlarged six times.
e. Egg on bud petiole, enlarged six times.

RASPBERRY FRUIT WORM.

a. Tip showing injury by beetles, natural size.



b. Tips with blossom buds injured by beetles, natural size.

RASPBERRY FRUIT WORM.

PLATE IV.

a. Injury to foliage by beetles.

b. Above, raspberry shoot from sprayed plot; 67 fruits set: Below shoo from check plot; all but 17 buds destroyed.

RASPBERRY FRUIT WORM.

the breeding jars. These subsequently died through being disturbed and because of the lack of moisture.... My observations, however, substantiate the statement of Dr. Fitch that they pupate in the soil."

Three cages with soil in the bottom were prepared by the writer in 1922 and full-grown larvae were placed in each. Two of the cages were placed in the insectary and the soil kept moist but otherwise undisturbed. The third cage was examined frequently. The larvae in the latter cage entered the ground at once and within two days had formed cells but failed to pupate and finally died. On October 26 the soil in one of the other cages was examined and instead of the pupae being present as expected, adult beetles were found. The same condition was found in the third cage. In order to check field conditions with those of the breeding cages, a visit was made to East Haven on October 28. The soil around the raspberry plants was examined and adults were found. All of the beetles obtained were in the first one-half inch of the top soil. Some of the beetles were rather soft but others seemed to be fully developed. Most of the beetles were lighter in color than those collected in spring, but several were of normal color. No pupae were found but as the soil was moist and lumpy it would have been difficult to find any that may have been present, so that further observations would be necessary to determine if all of the adults emerge in the fall. These observations differ from those of Dr. Fitch, who stated:...."in this situation (pupa stage) it remains at rest through the winter, and till the middle of May or a little later, when it changes to its perfect form, and is then a small beetle...."

In 1923, fruit infested with nearly full-grown larvae was placed in breeding cages and on September 6, a number of the larvae had pupated. The last larva observed in the material pupated between September 23 and September 25.

The field was visited on October 9 and pupae and one larva found in the soil. No adults were observed. An adult emerged on October 13 from a pupa brought to the laboratory.

Description.

Byturus unicolor Say is placed in the family Dermestidae of the Coleoptera. The members of this family occurring in Connecticut, with the exception of this raspberry beetle, feed upon dry animal and vegetable matter and include some of the well-known household pests such as the "larder beetle," "carpet beetle" and "museum beetle." In Europe, *Byturus tomentosus* Fabr., is one of the most serious pests of raspberries. It is closely allied to *B. unicolor* and its habits are somewhat similar.

The genus *Byturus* is readily separated from the other genera of the family having "the tarsi with the second and third joints bilobed beneath; front coxal cavities closed behind; claws armed

with a large basal tooth" while in the other genera the "tarsi are simple; front coxal cavities open behind; tarsal claws simple."

The original description of the beetle is as follows:[1]

"*B. unicolor.* Reddish yellow, hairy thorax, each side depressed, tergum dusky, inhabits Arkansas, eyes black, thorax posterior angles broadly depressed and slightly reflected, the depression continued on the side but narrowed towards the anterior angles, wings dusky, length three-twentieths of an inch. This species is most closely allied to *B. tomentosus* of the authors. A single specimen brought from Arkansas by Mr. Nuttal."

The beetles are oblong-oval, convex above, dull yellow to pale brown in color, rather densely and coarsely punctured and covered with fine, light colored hairs. Head large with prominent dark, coarsely granulated eyes. Antennae 11-jointed, terminating in a three-jointed club. Thorax wider than long, slightly broader at base than at apex, sides curved and with thin, depressed edges. Elytra about three times as long as wide. Length 3.7–4.5 mm. Shown on Plate I, d.

Egg. Average length 1.16 mm., width .42 mm. Elongate-oval, slightly enlarged towards one end. Color, nearly white, sometimes with a yellowish green tinge. Surface apparently smooth, but somewhat roughened without definite sculpturing when highly magnified. Shown on Plate I, a, Plate II, c, d, e.

Larva. Length 5.75 to 6 mm., width. 53 mm., nearly cylindrical, tapering towards either end. Each segment with sparse, light colored, stiff hairs arranged in two transverse rows, those of the first row shorter than those in the second. The ninth abdominal segment with a pair of tubercles enlarged at the base, tapering to a point and curved towards the front. The tenth segment consists of a short, cylindrical blunt proleg. General color yellowish white, head amber color with the mouth parts darker. There are five ocelli appearing as dark brown spots arranged as follows: three in a vertical row just back of the base of the antenna and two smaller ones back of and parallel to the two upper ocelli in the first row. Thoracic shield amber. The dorsal surface of the segments with a transverse band of amber to light brown covering the anterior two-thirds and extending about one-third the way down the sides. Shown on Plate I, b and c.

Pupa. Length 3.75 mm., width 1.5 mm., through the thoracic region, narrowing towards the end of the abdomen. Sparsely clothed with light colored hairs about .5 mm. in length. Color, creamy white when formed, later becoming a yellowish or amber color. Eye spots dark brown, prominent. Wing pads turning a light slate color before the adult emerges. Shown on Plate I, e.

Control Methods.

The treatment that has been recommended against this insect is to spray the foliage with lead arsenate at the rate of four pounds

(paste) to fifty gallons of water just before the beetles begin to feed in spring. Shallow cultivation in the fall to break up the pupal cells and expose the pupae has also been advised.

The only published account of spraying tests against this insect that the writer has seen is that of Goodwin in 1909. He reports that with one treatment, using the above formula, the injury was reduced from about thirty-five per cent. on the checks to eight or nine per cent. on the sprayed plot.

At East Haven, lead arsenate at the rate of two pounds (dry) to fifty gallons of water with three-fourths of a pound of calcium caseinate spreader was used in comparison with a dust mixture containing forty pounds of sulphur, ten pounds of dry lead arsenate and five pounds of hydrated lime. The block was divided lengthwise into two sections and the north ends of the rows of both sections were used as checks. The applications were made on May 12, when the adults were appearing in numbers but before there was any noticeable injury to the foliage. The field was examined on May 16 and it was found that the tips of the plants had made from an inch to an inch and one-half of growth since the treatment, and quite a number of beetles were observed on the new growth of the sprayed rows. There were noticeably fewer beetles on the dusted rows.

A second application was made on May 19 and examination made on May 22. While there were fewer beetles present on the treated plots than on the 16th, there were still more on the sprayed rows than on the dusted. No estimate was made of the blossom buds destroyed by the beetles but there was much less fruit set on the check than on the other plots. An examination of the fruit on June 29 showed the following results:

Treatment	Per Cent. Infested
Dust	10.
Spray	18.
Check	29.3

These results are not entirely satisfactory or conclusive from the standpoint of control but they indicate that the beetles can be poisoned with lead arsenate. The check plot, located by request of the owner at the north end, represented the minimum infestation of the field. As previously stated the insects in 1921 were more numerous towards the south end where nearly sixty per cent. of the fruit was infested, and it was expected that owing to this heavy infestation that the insects would be more evenly distributed throughout the field in 1922. The dust probably acted to a certain extent as a repellent. The owner informed the writer that an odor from the dust could be detected for several evenings after it had been applied.

One reason for the lack of control is undoubtedly due to the fact that the St. Regis is a rapid growing variety with the fruit

formed at the tips of the shoots. In order to keep the new growth coated it would be necessary to make several and frequent treatments during the time that the beetles are abundant.

In 1923, tests were continued in controlling this pest. The field was divided into three plots as in 1922. The same spray formula as applied in 1922 was used. The dust mixture consisted of eighty-five pounds of carrier (principally dolomite), fifteen pounds dry lead arsenate and two per cent. nicotine sulphate.

Four applications were made at intervals of about one week. The first was applied on May 14 as the adults were beginning to appear in numbers and the last application was made on June 7 as the first blossom buds were opening. Later applications would have undoubtedly poisoned the bees which were visiting the blossoms.

Owing to the comparatively dry season both the spray and the dust showed well on the foliage at the time of each subsequent treatment, but repeated applications were necessary to protect the new growth as it developed.

Tips were examined June 16 for injury to the fruit buds with the following results.

Treatment	No. of Buds Injured	No. of Buds not Injured	Per cent. of Injury
Spray	16	141	10.1
Dust	19	140	11.9
Check	86	47	64.6

Fruit from the different plots was picked and examined on June 30. On the check plot there was only about twenty per cent. as much fruit as on the treated plots. Plate IV, b, shows a shoot from the unsprayed plot and one from the check plot. Sixty-seven berries had set on the former and only seventeen on the latter. The percentage of wormy fruit was as follows:

Treatment	Per cent. of Fruit Infested
Spray	1
Dust	3
Check	40

The combined injury resulting from destroyed fruit buds and wormy fruit is given below:

Treatment	Per cent. of Fruit Destroyed
Spray	10.99
Dust	14.54
Check	78.76

Attention is called to the fact that the above treatments were not supplemented by any other methods of control which may be equally effective or even necessary to secure satisfactory results in a badly infested field.

General Recommendations.

Observations during the past two years have determined that *Byturus unicolor* is a difficult insect to control. In a badly infested field, it probably would be necessary to use every possible means to reduce the number of beetles, supplementing the spraying or dusting with the recommendations indicated below during the first season. The foliage should be kept well coated with lead arsenate from the time that the first beetles appear until the blossom buds open to such an extent that there is danger of poisoning bees.

If the fruit is infested with the worms to such an extent that it is unsalable, the second year's infestation can be greatly reduced by removing and burning the entire fruit clusters at about the time the earliest fruit begins to ripen. Observations during the past two seasons indicate that the eggs have practically all been laid at this time and that but few, if any, of the larvae have left the fruit to go into the ground.

Thorough, shallow cultivation as close as possible to the plants from late summer to early fall will tend to break up the pupal cases and expose the pupae to the elements. The pupae are fragile and in the laboratory cages were readily killed by stirring the soil, and quickly dried up when exposed on the surface. In the field the larvae and pupae have only been observed in the upper three-fourths of an inch of the soil.

During the present fall, poultry had had the run of the East Haven field and it was difficult to find larvae and pupae in the soil under the plants even in the check plot. Where raspberries are grown for home use only, the patch could often be located so that poultry could be turned into it during the time that the larvae and pupae are in the soil.

Literature.

[1] Say, Thomas (original description). Journal of the Academy of Natural Sciences of Philadelphia, Vol 3, page 197, 1823; Complete Writings, Vol 2, page 126, 1869.

[2] Packard, A. S. Guide to Study of Insects, page 448, 1869.

[3] Fitch, Asa. Transactions N. Y. State Agricultural Society, Vol. 30, pages 358–360, 1870–1872.

[4] Saunders, William. Report Entomological Society of Ontario for 1873, page 10, 1874.

[5] Fletcher, James. Central Experimental Farm (Canada), Report of Entomologist and Botanist for 1887, page 31.

[6] Lintner, J. A. Insects of New York, 8th Report, page 298, 1893.

[7] Goodwin, W. H. Ohio Agr. Expt. Station, Bulletin 209, 1909.

[8] Leng, C. W. Catalogue of the Coleoptera of America North of Mexico, page 189, 1920.

[9] Felt, E. P. 35th Report of the State Entomologist of New York for 1921, page 40, 1923.

BULLETIN 252 DECEMBER, 1923

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

The European Red Mite

PHILIP GARMAN

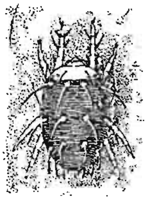


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Figure 1. European Red Mite, greatly enlarged.

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The European Red Mite in Connecticut Apple Orchards.

Paratetranychus pilosus Can. & Fanz.

BY PHILIP GARMAN, PH.D.

Brown foliage, a result of the feeding of the European red mite, was first noticed on apples in Connecticut in 1920, when a block of Baldwins in a large commercial orchard near Branford became discolored. Since that time the trouble has increased rather than decreased in the State, and the mite now seems to be well established, threatening serious damage in some sections every year. What can be done to hold it in check has been asked from time to time, and we are now able to offer what seems to be a practical remedy, together with facts about habits and life history of the mite which should enable the orchardist to gain control.

HISTORY.

The European red mite was described in 1876 from Italy: it has been noticed in several countries of Europe having been given considerable attention as a pest in Sweden. In America it has been present for many years, but has been confused with other species, notably, the clover mite (*Bryobia pretiosa* Koch) and the common red spider (*Tetranychus bimaculatus* Harvey) from both of which it is distinct. On the Pacific coast it has passed under the name of citrus mite and apparently others, and has done serious damage in that locality. It was noted in Canada in 1915,[1] by Frost in Pennsylvania[9] in 1919, was found in Connecticut in 1920,[10] and since then has been reported from Maryland, New York and Ohio. The mite was recognized as present in California by Essig[4] in 1922, though it has probably been there much longer.

NATURE OF THE INJURY.

A heavy infestation of red mites turns leaves of apple trees brown early in June, and if continued gives them a dead appearance in July. This results in undersized and poorly colored fruit and affects the vitality and set of fruit for the following season. On plums and apples, a little later, there is considerable defoliation. A moderate infestation leaves the trees with sickly foliage and prevents growth of fruit the latter part of the summer, a condition

often unnoticed by the orchardist, but very conspicuous as compared with trees free of mites.

Distribution.

The red mite is present in Connecticut, Massachusetts, New Jersey, New York, Maryland,[12] Pennsylvania, West Virginia and Ohio. It has also been reported from Canada. In the west, Oregon and California consider it worthy of attention and it will probably be found in many other localities where perhaps it is not numerous enough at present to invite attention.

In Connecticut it is well distributed, having been seen in, or received from, Fairfield, Hartford, Middlesex, New Haven and New London Counties. The most serious damage seems to have been done in the southern part of the State and little complaint has been heard from the more northern counties.

Host Plants.

The species has been found by the author on rose, pear, peach, plum, cherry, apple and elm. It is reported to infest prune trees in Pennsylvania,[2] and is known to infest almond, prune and citrus fruits in California.[3] Most damage is done to apples and plums in Connecticut, though occasionally peach trees in the vicinity of infested apples have been injured.

Habits and Life History.

Examine an infested tree in winter after the leaves have fallen and you will note on branches the size of a lead pencil (sometimes on those as much as two inches in diameter) a coating of small red eggs, which if numerous enough will not require magnification to see them. They are dark red in color and are most abundant around bud scars and in crevices—resembling a coating of red brick dust. Wise orchardists know the signs and know that trouble may be in store—and act accordingly. These are the winter eggs, which carry the pest over from season to season. Watch carefully and you will find them hatching about the middle of April or first of May; or, in terms of the development of the apple tree, at the time when the blossom buds of most varieties begin to show pink; better still when the leaves are about an inch long. From the twigs the young mites make their way to the leaves and begin to feed, completing their development in two weeks, but sometimes requiring longer if a cold spring is at hand. By the first of June, conditions being favorable, they begin to multiply rapidly, passing the entire cycle in three weeks or shorter if the weather is warm. The life period is such that an overlapping of broods now begins for the following reasons. The egg develops in 6–13 days or an average of nine days, and the mites require

about as long to complete their development, or long enough to begin laying eggs (nine days more). If we now allow 15 days as the average life of the adult during which time the eggs are laid, not all at one time but a few each day, then at the end of 15 days under favorable conditions the first eggs of the particular female will have hatched and will be well along to maturity, giving two different generations on the leaf at one time. This apparently takes place shortly after the first of June in Connecticut, making it impossible to apply separate sprays for different broods during the summer. In all, considering the length of the cycle, some six generations might easily occur in a single summer, but it is not always safe to figure natural laws or processes by such simple mathematics. The number of generations in this case is of minor importance, but our experience indicates that most damage is done in June and early July when multiplication is most rapid, and before enemies become numerous.

The female is not a great egg layer, but is capable of laying as many as 34 eggs, at the rate of one or two per day. By the middle of August, many eggs are laid on the twigs and in the calyx and stem cavities of the fruit, and by September 15 the winter eggs are being laid rapidly. The adults die shortly after and show no tendency to hibernate in this climate.

The time required for development in each stage is shown in the following tables:

TABLE 1—LENGTH OF INCUBATION PERIOD.

Eggs Laid	Eggs Hatched	Period, Days	Mean Temp., F.
May 16	May 29	13	63.2
May 18	May 29	11	64.2
May 21	May 29	8	....
May 21	June 1	10	67.2
June 24	June 30	6	....
June 24	June 30	6	....
July 11	July 17	6	73.1
Aug. 6	Aug. 14	8	....
Aug. 8	Aug. 16	8	....
Aug. 8	Aug. 17	9	....
Aug. 29	Sept. 6	8	....
Aug. 16	Aug. 30	14	65.5
Aug. 17	Aug. 30	13	66.4
Sept. 3	Sept. 9	6	72.0

TABLE 2—PERIOD FROM EGG TO ADULT.

Egg Hatched	Adult Obtained	Period, Days	Mean Temp., F.
May 29	June 5	7	66.6
June 1	June 8	7	....
June 9	June 19	10	65.1
June 10	June 17	7	....
July 11	July 16	5	77.1
July 25	Aug. 1	7	72.9
July 25	Aug. 3	9	....
Aug. 30	Sept. 9	10	....
Aug. 14	Aug. 23	9	65.4

TABLE 3—PREOVIPOSITION PERIOD OF ADULT FEMALE.

Female Emerged	First Egg Laid	Period, Days	Mean Temp., F.
June 7	June 10	3	61.0
July 8	July 9	1	71.3
July 16	July 19	3	79.2
July 16	July 19	3	79.2
Aug. 6	Aug. 8	2	....
Aug. 10	Aug. 17	7	71.8
Sept. 9	Sept. 11	2	....

TABLE 4—LENGTH OF LIFE OF ADULTS.

Adult Emerged	Adult Died	Period, Days	Mean Temp., F.
June 7	June 21	14 (female)	....
June 9	June 30	21	....
July 8	July 22	14 (female)	79.0
July 16	July 22	6 (female)	82.2
Aug. 10	Aug. 29	19 (female)	68.1
Aug. 3	Aug. 17	14 (male)	74.8
Aug. 6	Aug. 19	13 (female)	....

TABLE 5—EGGS LAID BY ADULT FEMALES.

First Egg	Adult Died	Total Number
June 10	June 21	18
July 9	July 22	22
June 10	June 21	16
June 9	June 30	34

TABLE 5a—LIFE HISTORY OF EUROPEAN RED MITE.†

Eggs Laid	Eggs Hatched	Adult Obtained	Eggs from Adult	Total Period, Days
May 21	May 29	June 5 (male)	......	15
May 21	......	June 7	June 10	20
July 5	......	July 16 (male)	......	11
July 7	......	July 16	July 19	12
July 21	......	Aug. 3 (male)	......	13
July 19	July 25	Aug. 1 (male)	......	13
Aug. 6	Aug. 14	Aug. 23	......	17

Early stages feed mostly on the underside of the leaf, but as the leaf becomes crowded, many adults move to the upper surface and feed there. Very little web is spun at any stage, the larvae and nymphs spinning more than the adults.

METHODS OF SPREAD.

Wind is the most important agent in local distribution of the red mite. Many spin down from the leaves on short threads and if a strong wind is blowing, are probably carried for a considerable distance. Distribution of infested nursery stock is probably responsible for spread of the mite since the eggs are small and easily overlooked. Probably many are carried on the fruit, especially winter apples, which sometimes contain eggs in calyx and stem cavities.

† Continuous records of single individuals.

THE DIFFERENT STAGES.

The European red mite passes through the following stages:—egg: active larva—quiescent larva: active first nymph—quiescent first nymph: active second nymph—quiescent second nymph: adult male or female. During quiescent periods the mites are inactive and no food is taken. The male usually emerges shortly before the female and awaits the emergence of the latter. Eggs are laid within a few days after emergence of the adult female. There is no difference in the number of immature stages of male and female.

DESCRIPTION.

Adult females are dark velvety red in color, the nymphal stages and the male dark brown or green. Winter eggs are dull red, summer eggs usually brown.

Egg—Slightly flattened above, radially grooved and with a short stalk arising from the center, the stalk being longer than the vertical diameter of the egg. Transverse diameter of egg .15 mm.

Larva—Nearly orange in color when recently hatched, later turning dark green or brown; mite with three pairs of legs; length .16–.18 mm.

Protonymph—Very dark green or brown in color; with four pairs of legs, the latter quite pale; length .19–.25 mm.

Deutonymph—Very dark green or brown; legs paler; length .25–.30 mm.

Adult, female—Color dark velvety red or brown with conspicuous white dots on dorsum at base of setae; 26 setose dorsal bristles in all; tarsi provided with a single claw widest at the mid point and with apparently five (there are probably six) appendiculate spurs projecting at right angles (Fig. 2, 4); four tenent hairs with hooked tips arise from the base of the claw and exceed it considerably in length; collar tracheae consisting of a single tube (Fig. 2, 3) dilated at tip to form a spherical chamber; maxillae consisting of four segments, the last tipped with a short spatulate body, probably representing an additional segment; next to the last segment with a strong hook, and the last with five setae (two apical, two basal on the dorsum, and one lateral) and a clavate hair between the two dorsal pairs; length of adult, .28-.31 mm.

Male—Much smaller than the female, the tip of the abdomen being much more pointed and the color usually brown, never red; genitalia as in Fig. 2, 5; length .26–.28 mm.

DIFFERENCE FROM OTHER ECONOMIC SPECIES.

There are abundant differences between the European red mite and the common red spider, *Tetranychus bimaculatus* Harvey. The dorsal setae are smaller in the latter species and the collar tracheae are much different, being hooked and segmented (see Fig.

2, 8). The eggs are spherical, usually pale, and without grooves or, stalk.

Bryobia pretiosa Koch,† the clover mite, is distinguishable at sight, being considerably flatter and wrinkled above and with a number of flat scalloped plates around the margin of the body of the adult. There are two claws on each tarsus instead of one and the front pair of legs is much longer than any of the others. The eggs are red but are larger, usually measuring .19–.20 mm. in diameter, and lack the radial grooves and the dorsal stalk present in *P. pilosus*.

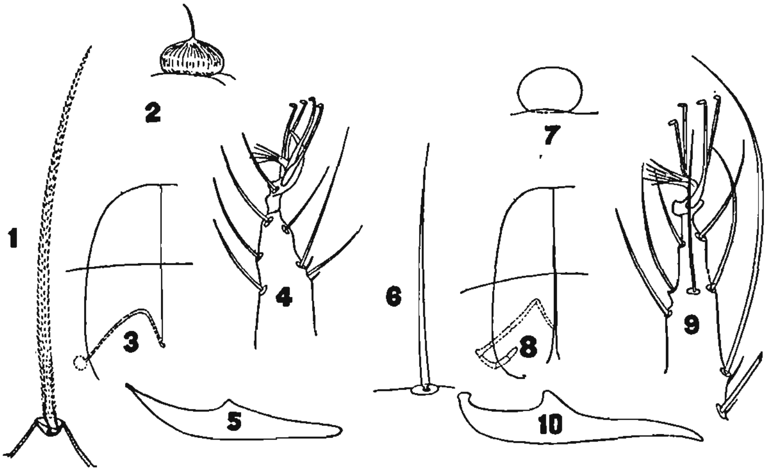


Figure 2. Structures of European red mite, *Paratetranychus pilosus* Can. and Fanz. and common red spider, *Tetranychus bimaculatus* Harvey.

1, *Paratetranychus pilosus*, seta of dorsum 846 times enlarged; 2, egg, 14 times enlarged; 3, collar tracheae and mandibular plate, 714 times enlarged; 4, tarsus of first pair of legs of female, 921 times enlarged; 5, penis, 1400 times enlarged.

6, *Tetranychus bimaculatus*, seta of dorsum, 846 times enlarged; 7, egg, 14 times enlarged; 8, collar tracheae and mandibular plate, 714 times enlarged; 9, tarsus of first pair of legs of female, 921 times enlarged; 10, penis, 1400 times enlarged.

Number of Mites Necessary to Produce Browning.

Some varieties of apples withstand much more of an infestation without showing the effects than others. Spy and Wealthy trees were browned in 1923 by 12 to 33 mites per leaf, estimated from the number of cast skins found after browning was noticed. Hurlbut trees with 55 to 133 per leaf suffered severe browning.

† *Bryobia pratensis* Garman.

Varietal Preferences.

Greening trees rarely have as many mites per leaf as other varieties, and no instances have been observed in Connecticut where severe injury has been done to this variety. Baldwin is perhaps the most commonly injured, but Hurlbut, York Imperial, McIntosh, Wealthy, Northern Spy and Fall Pippin have been injured, in some cases severely. Thin leaved varieties are most susceptible.

Natural Enemies.

Some of the most puzzling features of the appearance and disappearance of the red mite are connected with the occurrence of predaceous enemies. An orchard may, for instance, be heavily infested one season and show almost no mites the following year, although no spraying has been done in the meantime. This is often, though not always explained by the presence of enemies which in Connecticut seem able to conquer and almost eradicate the mite once every two or three years. Thus in 1922, a heavy infestation at North Branford was reduced almost to the zero point and no outbreak occurred the following year. In 1923, thrips, coccinellids, and small Hemiptera such as *Triphleps insidiosa* were numerous in orchards, and greatly checked the mite in several places.

Three species of thrips† were found, a small bug‡, a lady beetle§, a predaceous mite‖, and a small undetermined Neuropteron. All of these destroyed eggs of the red mite with relish, one thrips being observed to eat 19 eggs in twenty-four hours, while an adult *Stethorus* on being observed took six eggs and three mites within five minutes.

Enemies of the red mite are most numerous in July and August and when numerous enough keep the pest in check in spite of its rapid multiplication at this time of year. One or two thrips per leaf are apparently enough to keep in advance of an infestation because of their enormous appetite for mite eggs, and their habit of attacking mites themselves when eggs are scarce. They often leave the foliage and twigs with empty transparent egg shells, having sucked out their contents and departed.

Weather Conditions Affecting Abundance.

Adverse weather conditions are responsible for subsidence of outbreaks in some cases, but it is sometimes difficult to say whether this or the abundance of enemies is the cause. Conditions favorable to the mite may be favorable to development of the enemies or vice-versa. It has been reported that bad outbreaks have followed a very severe winter and the great numbers of mites in 1920 and

† *Leptothrips mali* Fitch, *Scolothrips 6-maculatus* Pergande and *Haplothrips* sp.; determined by Dr. A. C. Morgan.
‡ *Triphleps insidiosa* Say.
§ *Stethorus punctum* Leconte.
‖ *Seius pomi* Parrott.

1923 certainly followed abundant snows and cold weather. However, a serious outbreak occurred in 1922 after a rather mild winter, and the infestations in 1923 did not become serious until midsummer, whereas if cold weather had much effect this should have begun more promptly. Heavy rainfall or better a series of showers at frequent intervals in summer is successful in keeping an infestation from gaining headway, as witnessed in this State in 1922. This is due to the fact that many mites are washed from the leaves and are unable to regain the tree. It is quite possible that a rainy period in September would decidedly affect the abundance of the mite the following season, though no cases of this sort have been observed. In 1923, the prolonged dry period from the middle of June to September favored development and several orchards were damaged severely.

Control Measures.

Owing to the uncertainty that weather and enemies will produce a balance in favor of the orchardist, treatments for control must be considered and a regular schedule adopted. There are periods when the mite is especially vulnerable and a thorough spray is of much value; and it is a good policy to learn to know the mite in its different stages so that damage may be anticipated and prevented. As with many insects the best time to concentrate efforts is in early spring and sprays at this time should go far towards a control for the entire season, especially in this climate. It is well, therefore, to keep a sharp lookout for winter eggs when the annual pruning is done and not to wait until the leaves turn brown before considering treatment.

Sprays for the Winter Eggs.

The first attack should be on the overwintering eggs which may be reached with sprays and largely destroyed. Laboratory tests were conducted in 1920-21 with a view to finding the most effective treatments for this purpose. Some of the tables are given below together with tests of several other compounds reaching us since these were made.

In the tables, the names of a number of proprietary compounds appear, and the following explanation in regard to their general composition and source is necessary. Such compounds as lime-sulphur, and Scalecide are too well known to need comment.

"*Jarvis Compound.*"— A miscible oil containing phenol; manufacturer J. T. Robertson; obtained from Apothecaries Hall Co., Waterbury, Conn.

"*Kero-spray.*"—A commercial kerosene emulsion; manufacturer, Kero-Spray Co., 198 9th St., Jersey City, N. J.

"*Keresol.*"—An oil spray containing 70 per cent. kerosene; obtained from Mr. A. A. Claasen, Mascher and Turner Streets, Philadelphia, Pa.; effect of spray on trees unknown.

"Sulco V. B."—A spray containing fish-oil and small per cent. phenol; manufactured by Cook & Swan Co., 148 Front St., New York; obtained from Apothecaries Hall Co., Waterbury; effect on apple trees unknown, probably safe.

"Wormol."—A miscible oil recommended for use against peach borers by the General Chemical Company; obtained from General Chemical Company, 25 Broad St., New York, N. Y.; effect upon apple trees unknown.

"B. T. S."—Barium tetrasulphide, a lime-sulphur substitute; a General Chemical Company product.

"Sunoco Spraying Oil".—A miscible mineral oil; apparently safe on apple trees; sold by Sun Oil Company, Philadelphia, Pa.

"Target Brand Scale Destroyer."—A miscible oil containing phenol; sample submitted by the Interstate Chemical Company, Jersey City, N. J.

TABLES SHOWING RESULTS OF TREATING EGGS OF EUROPEAN RED MITE WITH DIFFERENT INSECTICIDES.

TABLE 6.

Exp. No.	Treatment	Total Number of Eggs Used	Number Hatched	Per Cent. Hatched	Date Treated	Date Examined
1.	Kerosene emulsion (10 per cent. kerosene)	660	402	60.9	Mar. 16	Apr. 29
2.	Kero-spray 1 part-25 parts water	298	166	56.0	"	"
3.	Sulco V. B. 1 part-25 parts water	502	255	50.7	"	"
4.	Keresol 1 part-18 parts water	442	265.	59.9	"	"
5.	Jarvis Compound 1 part-15 parts water	104	6	5.7	"	"
6.	Scalecide 1 part-15 parts water	237	22	9.2	"	"
7.	Lime-sulphur 1 part-9 parts water	652	253	38.8	"	"
8.	Dry lime-sulphur 12 lbs.-50 gals. water	418	125	29.9	"	"
9.	B. T. S. 12 lbs.-50 gals. water	349	162	46.4	"	"
10.	Scalecide 1 part-25 parts water	341	115	33.7	"	"
11.	Check no treatment	265	151	56.9	—	"
12.	Scalecide 1 part-15 parts water	150	8	5.3	April. 7	Apr. 29
13.	Scalecide 1 part-15 parts water	669	9	1.3	"	"
14.	Scalecide 1 part-35 parts water	838	53	6.3	"	"
15.	Scalecide 1 part-25 parts water	744	68	9.1	"	"
16.	Scalecide 1 part-50 parts water	462	47	10.1	"	"
17.	Check no treatment	253	164	65.0	—	"
18.	Check					

TABLE 7.

Exp. No.	Treatment	Total Number of Eggs Used	Number Hatched	Per Cent. Hatched	Date Treated	Date Examined
1.	Lime-sulphur 1-9 Nic. Sulphate 1-500	649	189	29.1	Dec. 29	Feb. 23
2.	" " "	2,166	544	25.1	Feb. 8	Mar. 2
3.	Lime-sulphur 1 part-9 parts water	403	45	11.1	Apr. 5	Apr. 15
4.	" " "	378	18	4.7	Mar. 12	Mar. 28
5.	" " "	773	268	34.6	Dec. 29	Feb. 23
6.	Lime-sulphur 1-9 Nic. Sulphate 1-500	165	80	48.4	Apr. 13	Apr. 28
7.	" " "	221	54	24.4	Apr. 13	Apr. 29
8.	Lime-sulphur 1 part-9 parts water	526	351	66.7	Dec. 29	Apr. 28
9.	" " "	652	253	38.8	Mar. 16	Apr. 29
10.	" " "	449	132	29.4	Feb. 17	May 3
11.	" " "	299	83	27.7	Mar. 10	May 2

Notes.

Table 6. Eggs in tests 1-11 were taken from the same branch. Those in 12-18 were from another branch. All eggs dipped in the different solutions, not sprayed.

Table 7. Nos. 1-5 were kept indoors after treatment; 6-11 outdoors. Nos. 5 and 6 were sprayed, other dipped.

TABLE 8.

1.	Dry lime-sulphur ½ oz.-1 pint water	302	114	37.7	Apr. 5	Apr. 15
2.	" " "	274	6	2.1	Mar. 12	Mar. 28
3.	" " "	197	74	37.5	Mar. 4	Mar. 25
4.	" " "	418	125	29.9	Mar. 16	Apr. 29

TABLE 9.

1.	B. T. S. ½ oz.-1 pint water	1,047	368	35.2	Feb. 8	Mar. 2
2.	" " "	374	124	33.2	Apr. 5	Apr. 15
3.	" " "	438	35	7.9	Mar. 12	Mar. 28
4.	" " "	234	34	14.5	Mar. 4	Mar. 25
5.	½ oz.-1 pint water	349	162	46.4	Mar. 16	Apr. 29
6.	B. T. S. ½ oz.-1 pt. water N.S. 1 part-500 part water	282	126	44.6	Apr. 5	Apr 29

TABLE 10.

1.	Scalecide 1-15†	773	27	3.5	Dec. 29	Feb. 23
2.	" 1-15	1,078	0	0.0	Feb. 8	Mar. 2
3.	" 1-15	412	0	0.0	Apr. 5	Apr. 15
4.	" 1-15	67	0	0.0	Mar. 12	Mar. 28
5.	" 1-25	173	0	0.0	Mar. 16	Apr. 4
6.	" 1-50	356	11	3.0	Mar. 16	Apr. 4
7.	" 1-15	119	0	0.0	Mar. 4	Mar. 25
8.	" 1-15	409	135	33.0	Dec. 29	Apr. 28
9.	" 1-15	104	6	5.7	Mar. 8	Apr. 29

† Proportions of Scalecide to water.

TABLE 10—*Continued.*

Exp. No.	Treatment	Total Number of Eggs Used	Number Hatched	Per Cent. Hatched	Date Treated	Date Examined
10.	Scalecide 1-25	341	115	33.7	Mar. 9	Apr. 29
11.	" 1-50	150	8	5.3	Apr. 7	Apr. 29
12.	" 1-15	669	9	1.3	Apr. 7	Apr. 29
13.	" 1-25	744	68	9.1	Apr. 7	Apr. 29
14.	" 1-35	838	53	6.3	Apr. 7	Apr. 29
15.	" 1-50	462	47	10.1	Apr. 7	Apr. 29
16.	" 1-15	326	55	16.8	Feb. 17	May 3

Notes.

Table 8. Nos. 1-3 kept indoors, 4 outdoors.

Table 9. Nos. 1-4 kept indoors, 5 and 6 outdoors.

Table 10. Tests 1-7 were kept indoors after treatment; 8-16 were kept outdoors. Numbers 10-15 were sprayed, others were dipped in spray solutions.

TABLE 11.

Exp. No.	Treatment	Total No. of Eggs Used	No. Hatched	Per Cent. Hatched	Date Treated	Date Examined
1.	Sunoco spraying oil 1-15	233	4	1.7	Feb. 1	Mar. 8
2.	Sunoco spraying oil 1-15	262	1	.4	Mar. 15	Apr. 15
3.	Sunoco spraying oil 1-25	180	6	3.3	Mar. 15	Apr. 15
4.	Sunoco spraying oil 1-50	325	56	14.1	Feb. 3	Mar. 8
5.	Lime-sulphur, 1-6......	297	68	22.8	Feb. 3	Mar. 8
6.	Lime-sulphur, 1-9......	224	77	29.4	Feb. 3	Mar. 8
7.	Target brand scale destroyer, 1-15..........	357	3	.8	Feb. 3	Mar. 8
8.	Target brand scale destroyer, 1-50.........	265	37	13.9	Feb. 3	Mar. 8
9.	Red engine oil 1% emulsion with fish oil soap..	299	0	.0	Mar. 15	Apr. 15
10.	Red engine oil 2% emulsion with fish oil soap..	322	2	.6	Mar. 15	Apr. 15
11.	Scalecide 1-15.........	252	4	1.5	Mar. 15	Apr. 15
12.	Check, no treatment....	200	143	71.5	———	Mar. 8
13.	Check, no treatment....	175	136	77.7	———	Apr. 15
....						
14.	Lime-sulphur 1-8......	666	148	22.2	Apr. 11	May 15
15.	Scalecide 1-15.........	644	2	.3	Apr. 11	May 15
16.	Sunoco spraying oil 1-15	573	2	.3	Apr. 11	May 15
17.	Red engine oil 2% emulsion with fish oil soap..	646	31	4.8	Apr. 11	May 15
18.	Check, no treatment....	361	127	35.1	———	May 15

TABLE 12 (CHECKS).

Exp. No.	Total Number of Eggs Used	Number Hatched	Per Cent. Hatched	Date Obtained	Date Examined
1.	1,956	345	17.6	Dec. 29	Feb. 23
2.	527	263	49.9	Feb. 9	Mar. 4
3.	60	45	75.0	Feb. 10	Mar. 4
4.	2,421	1,477	61.0	Feb. 8	Feb. 23
5.	334	326	97.6	Apr. 5	Apr. 15
6.	359	324	90.2	Apr. 8	Apr. 28
7.	208	185	88.9	Mar. 4	Mar. 25
8.	402	223	55.4	Mar. 10	Mar. 28
9.	403	333	82.6	Mar. 11	Mar. 28
10.	430	342	79.7	Mar. 12	Mar. 28
11.	255	209	81.9	———	Apr. 4
....					

TABLE 12 (CHECKS)—*Continued.*

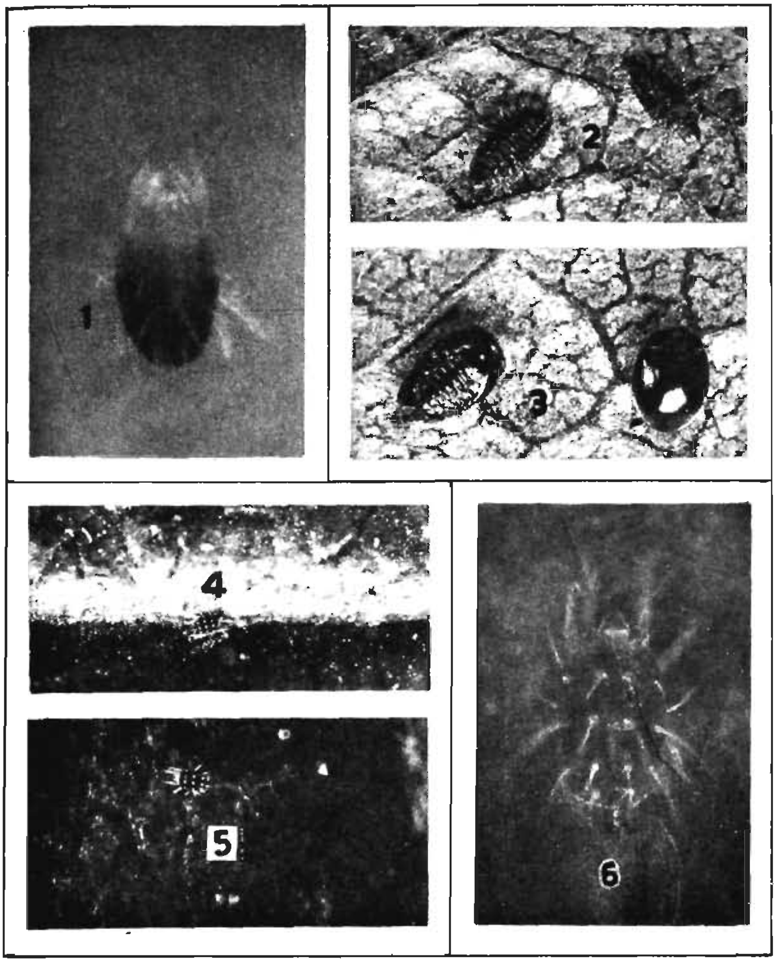
Exp. No.	Total Number of Eggs Used	Number Hatched	Per Cent. Hatched	Date Obtained	Date Examined
12.	421	181	42.9	Dec. 29	Apr. 28
13.	265	151	56.9	Mar. 16	Apr. 29
14.	253	164	64.8	Apr. 7	Apr. 29
15.	100	45	45.0	Apr. 7	Apr. 29
16.	162	109	67.3	Apr. 13	Apr. 28
17.	120	20	16.6	Apr. 4	Apr. 28
18.	155	85	54.8	Apr. 5	Apr. 29
19.	531	337	63.4	Feb. 17	May 3
20.	188	114	60.6	Mar. 10	May 2

COMPARATIVE MORTALITY OF TREATED EGGS OF EUROPEAN RED MITE, KEPT OUTDOORS AND INDOORS AFTER TREATMENT.

TABLE 13.

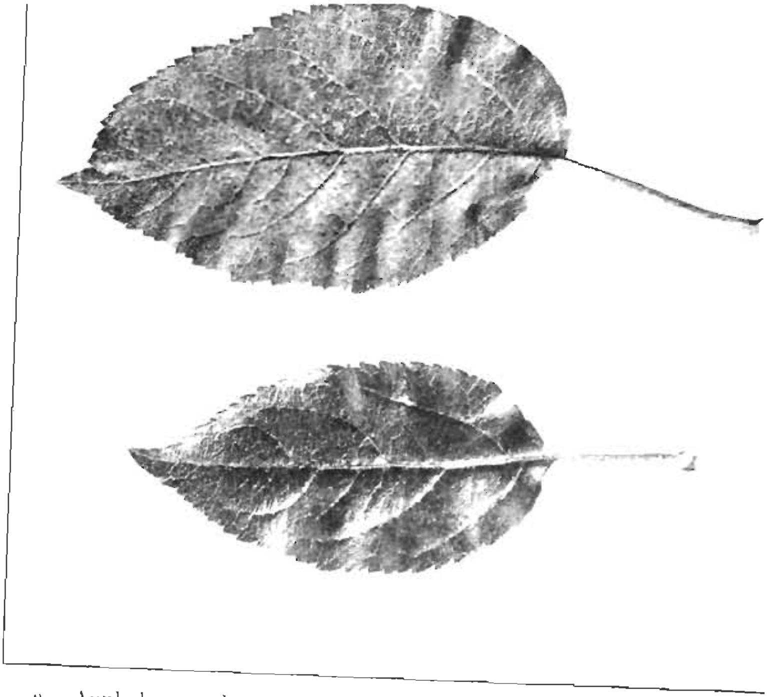
Treatment	Hatched Per Cent.	Possible Kill Per Cent.	Number of Eggs Used	
Check, no treatment	61.0	0	7,355	Indoors
	54.9	0	2,195	Outdoors
Kero-spray	86.5	0	445	Indoors
	55.7	0	298	Outdoors
Sulco V. B.	49.9	18.6	879	Indoors
	48.0	12.5	958	Outdoors
Keresol	34.2	44.0	385	Indoors
	59.9	0	442	Outdoors
Linseed oil emulsion	56.0	8.4	841	Indoors
	26.1	52.5	352	Outdoors
B. T. S.	26.7	56.3	2,093	Indoors
	45.6	16.8	631	Outdoors
Lime-sulphur; liquid 1-9	22.1	63.8	3,596	Indoors
	43.1	21.4	2,515	Outdoors
Lime-sulphur; dry	25.0	59.0	773	Indoors
	29.9	45.5	418	Outdoors
Kerosene emulsion	31.6	48.2	227	Indoors
	60.9	0	660	Outdoors
Wormol, 1 part in 15 parts water	5.4	91.1	419	Indoors
	14.7	73.2	292	Outdoors
Scalecide	1.2	98.1	2,978	Indoors
	9.9	81.8	4,043	Outdoors
Jarvis Compound	0	100	792	Indoors
	6	89.1	104	Outdoors

PLATE V.

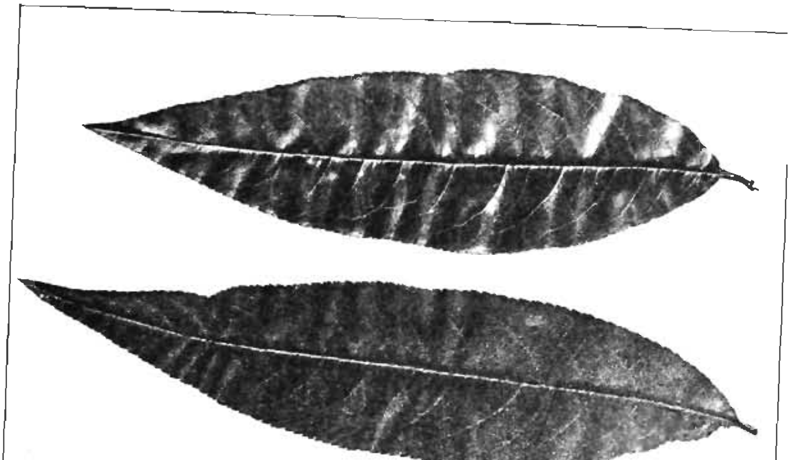


1. Quiescent nymph of European red mite, enlarged 80 times. 2. Larvae of predaceous enemy (*Stethorus punctum* LeConte). 3. Pupa and adult of same, enlarged 10 times. 4 and 5. Adult females of European red mite, enlarged 13 times. 6. Adult female, enlarged 80 times.

EUROPEAN RED MITE.



a. Apple leaves, showing leaf injured by European red mite (above), uninjured (below).



b. Peach leaves, showing leaf injured by European red mite (below), uninjured (above).

EUROPEAN RED MITE.

a. Infested apple tree which has lost much foliage from the attacks of the mite.

b. Eggs on calyx end of apple, and on twig, three times enlarged; insert, same from twig, enlarged about ten times.

EUROPEAN RED MITE.

PLATE VIII.

a. View in orchard of Smith T. Bradley, North Branford, showing untreated trees partially defoliated by mite.

b. View in same orchard showing trees which were sprayed with linseed oil emulsion.

EUROPEAN RED MITE.

Notes.

Table 12. Eggs listed here were not treated with any insecticide. Numbers 1-11 were kept indoors in moist jars; 12-20 outdoors.

Table 13. The percentages in the column headed "possible kill" were obtained by comparing each with the check hatch, obtaining the actual hatch, and subtracting this number from 100, thereby obtaining the per cent. killed. Where the per cent. hatched is higher than the check it is obvious that the insecticide has no killing power.

SUMMARY OF VARIOUS TREATMENTS.

TABLE 14.

Exp. No.	Treatment	Hatched Per Cent.	Possible Kill Per Cent.	Number of Eggs Used
1.	Check, no treatment	55.2	0	9,550
2.	Kero-spray.	74.1	0	743
3.	Sulco V. B	49.2	10.9	1,837
4.	Keresol.	47.9	13.3	827
5.	Linseed oil emulsion.	46.3	16.2	1,193
6.	B. T. S.	31.1	43.7	2,724
7.	Lime-sulphur (liquid).	30.8	44.3	6,111
8.	Lime-sulphur (dry).	26.3	52.4	1,191
9.	Kerosene emulsion	12.9	76.7	887
10.	Wormol	9.2	83.4	711
11.	Scalecide.	7.6	86.2	7,021
12.	2% Red engine oil emulsion. . .	4.8	91.3	646
13.	Jarvis compound.	.6	99.0	896
14.	Sunoco spraying oil	.3	99.5	573

Different authorities have claimed that dormant or delayed dormant sprays of lime-sulphur either killed the mites before hatching, prevented them from reaching the leaves, or killed them by continued action after reaching the leaves. Although lime-sulphur will kill some of the eggs as shown in the tables, it has been our experience (see Table 15) that it does not prevent them from reaching the leaves or kill them off in appreciable numbers after they begin to feed. It is in fact a much less efficient ovicide for the red mite than miscible oils. A fairly convincing example of this is found in the table below, which gives the results of a test conducted at the Experiment Station Farm in 1923.

TABLE 15—EFFECT OF FIELD TREATMENTS ON THE WINTER EGG.

Treatment	Number of Fruit Spurs Examined	Number with Live Mites on Leaves	Per Cent. Infested
Scalecide 1-15.	978	56	5.7
Lime-sulphur 1-9	975	972	99.6
Check, no treatment.	1,000	1,000	100.0

Examination of the trees during the winter indicated a nearly equal infestation of all blocks. Sprays were applied at the latest possible date considering the development of the trees. Nearly a thousand fruit spurs in each block of about 20 trees were examined, every twig included having eggs on it or at its base. It

will be seen that lime-sulphur checked their development little or none, while the miscible oil used was considerably more effective.

This condition continued well into the summer and trees receiving lime-sulphur alone as a delayed dormant spray were in practically the same condition as those receiving no spray, that is, in the amount of infestation on the leaves. What virtue there is in lime-sulphur seems to rest mainly with early summer sprays and not so much with the delayed dormant. Early summer sprays at 1.5–50 or 1–50 have been successful in three different experimental orchards in keeping the mite in control—and this without any dormant or delayed dormant spray whatsoever. This, together with the information in Table 15, indicates that lime-sulphur dormant or delayed dormant sprays are of little value in red mite control.

It will be noted in Tables 7, 9 and 10 that there is a general reduction in percentage of hatch after treatments as the season advances from December to April or May. This is probably due to embryonic development, but the membranes do not split as in the case of aphids. The outer membrane, however, does loosen up and may be peeled off with a needle several days before the mite hatches. These facts were corroborated in practical experience at the Conyers Farm orchard at Greenwich, in charge of Mr. G. A. Drew. Fall spraying in this orchard with miscible oil killed a very small per cent., while spring applications were quite effective.

Scalecide is the only miscible oil which has been given a field test, and it is shown to be effective. There are other oil emulsions, however, which should do the work, and some, notably the home-made lubricating oil emulsions, apparently are causing no damage.[8] There is an element of danger in using them, and it is well to observe some precautions in applying.

1. Make sure that all of the oil emulsifies, leaving none floating on the surface of the water in the spray tank. This condition will often follow the use of old material which has been on hand for a year or more. In most cases it is best to have fresh stock.
2. Do not drench the trees; spray lightly, covering the outer twigs and smaller branches.
3. Do not spray in weather so cold that the spray freezes.
4. Apply before the buds break, as a late dormant spray. This usually falls several weeks before the *delayed dormant spray.*
5. Do not use at all unless red mite eggs are very numerous, or unless you expect a serious outbreak; an application of miscible oil once every three years should be sufficient when the mite is once in control.

Summer Sprays.

Different substances have been tested on the mites themselves for killing power, and the results are given below in Table 16. Such tests are not so satisfactory as similar tests for the eggs, be-

cause of the fact that the mite is susceptible to changes in temperature and also to condition of the food plant. At any rate, there is considerable more variation in the results obtained, though they indicate in a general way the effectiveness of soaps, lime-sulphur solutions, and oil emulsions.

TABLE 16—RESULTS OF LABORATORY TESTS TO CONTROL MITES.

Exp. No.	Insecticide Used	No. Dead	No. Alive	Per Cent. Dead	Temp. of Air F	Dates
1.	Ivory soap flakes 2 lbs.—50 gals..........	67	12	84.8		May 20–22
2.	Ivory soap 2 lbs.—50 gals. plus Melrosine 1 part to 100.......	71	14	83.5		May 20–22
3.	Ivory soap flakes 2 lbs.—50 gals..........	409	2	99.5	73	May 13–18
4.	Ivory soap flakes 2 lbs.—50 gals..........	406	4	99.0	80.5–82	May 13–18
5.	Lux 2 lbs.—50 gals...	107	1	99.0	73	May 13–18
6.	Lux 2 lbs.—50 gals...	164	3	98.1	80.5–82	May 13–18
7.	Potash fish oil soap 10 lbs.—50 gals.......	12	14	46.1		May 23–25
8.	Fish oil soap 5 lbs.—50 gals............	13	41	24.0		May 23–25
9.	Fish oil soap 10 lbs.—50; sulphur 16 lbs. 50 gals............	16	93	14.6	80.5–82	May 27–31
10.	Borax soap 4 lbs.—48 gals. water.........	128	26	83.1	60–79	Aug. 17–18
11.	Linseed oil emulsion 1 part—20 parts water	81	5	94.1	70–74	Aug. 17–18
12.	40% nicotine sulphate ¾ pt.—50 gals.....	114	5	95.7		July 28–30
13.	Borax soap 6 lbs.—50 gals...............	141	6	95.9		July 28–30
14.	Fels naphtha soap 4 lbs.—50 gals.......	15	0	100		July 28–29
15.	Star soap 4 lbs.—50 gals...............	23	2	92		July 29–30
16.	Dusted with sulphur..	22	59	27.1	73	May 12–18
17.	Dusted with sulphur..	101	2	98.0	80.5–82	May 12–18
18.	Lime-sulphur 1—40 nicotine sulphate 1—500...........	36	2	95.0	60–79	Aug. 15–16
19.	Lime-sulphur 1—40; nicotine sulphate 1—500............	141	18	88.7	60–79	Aug. 17–18
20.	Ace-Hy 1—400†	108	254	29.8		June 31–July 1
21.	Ace-Hy 1—200†	40	2	95.2		Aug. 29
22.	Lime-sulphur 1—43¼ gals...............	79	28	73.8		July 28–30
23.	Check, no treatment..	4	53	9.5	73	May 12–18
24.	Check, no treatment..	22	31	41.7	80.5–82	May 12–18
25.	Check, no treatment..	12	70	14.6		May 20–22
26.	Check, no treatment..	2	84	2.3	60–79	Aug. 17–18

† An insecticide no longer on the market; containing cyanide (CN) as the active ingredient.

Sulphur dusts are variable, both in laboratory and in the field, but at least one factor influencing their effectiveness is found in the temperature of the atmosphere as shown in the two following charts, giving the killing power of sulphur dust and a dust containing 88 per cent. sulphur and 10 per cent. lead arsenate.

"Pomodust"† is now on the market and was apparently effective in controlling the red mite under the weather conditions experienced in 1923. The totally different action of sulphur dusts in

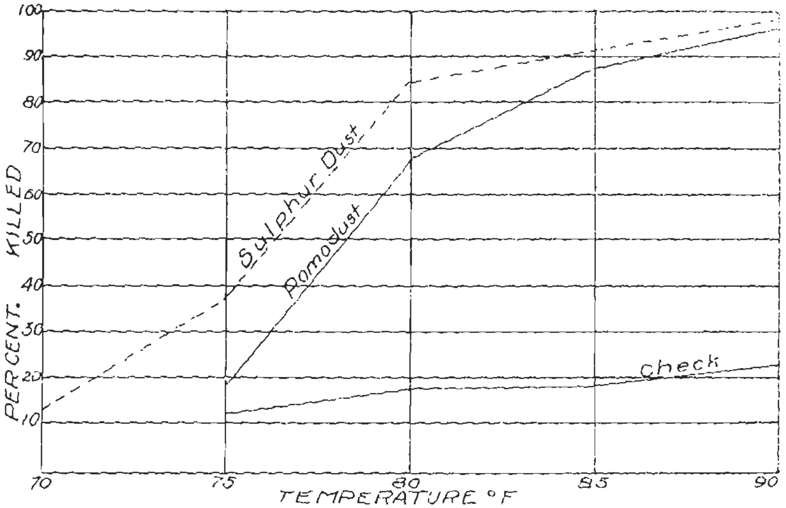


Chart 1. Showing kill obtained with sulphur dust and "Pomodust" at different temperatures; exposure in each case 24 hours.

1922 may be explained by the lack of excessive heat, and the dry weather which doubtless influenced the results in 1923.

Field tests have been conducted in five different orchards in Connecticut. The first were carried out at the Plant Brothers orchard in Branford in 1920. Soap, soap and nicotine sulphate, and sulphur-arsenate-nicotine dust were tried, but results were inconclusive due to the lateness of the applications. In 1921, no field tests were conducted but in 1922 serious outbreaks occurred and experiments were undertaken in three different orchards. Good control was secured with linseed oil emulsion, soaps, and a lime-sulphur-lead-arsenate-nicotine mixture. Tests at the Bradley orchard showed good control with linseed oil emulsion and with fish oil soap. Good control, however, was obtained with borax soap and lime-sulphur-lead-arsenate-nicotine combination in the

† Chemical analysis by the Connecticut Station, Department of Chemistry, showed that it contains sulphur 87.79 per cent., lead arsenate 9.80 per cent., and a trace of iron; water soluble arsenic .24 per cent.

ilford orchard of F. N. Platt. Counts were not made in the Milford orchard, but from a practical standpoint results were good, since the foliage continued green throughout the summer.

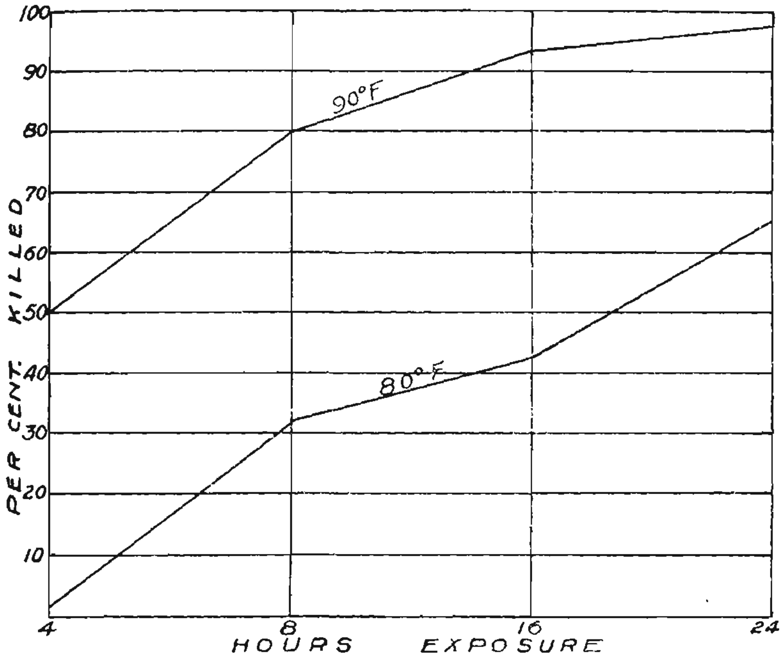


Chart 2. Showing kill obtained with "Pomodust" at different temperatures and different lengths of exposure.

TABLE 17—RESULTS OF FIELD TESTS WITH SOAPS, LINSEED OIL EMULSION AND SELF-BOILED LIME-SULPHUR IN BRADLEY ORCHARD.

Insecticide Used	No. Alive	No. Dead	Per Cent. Dead	No. of Leaves Examined	No. of Twigs Examined	Date of Treatment	Date of Examination 1922
Linseed Oil 1 gal.† Ivory soap 1½ lbs. Water 100 gals...	718	1,524	67.9	80	10	June 2	June 6
Ivory soap 6 lbs. Water 200 gals...	1,743	779	30.8	60	9	June 2	June 6
"Kerospray" 1 gal. —100 gals.....	916	381	29.5	50	6	June 2	June 6
Fish oil soap 14 lbs.—200 gals..	691	655	48.6	54	6	June 2	June 7
Self-boiled lime-sulphur (8-8-50) Kayso 2½ lbs.—200 gals.......	951	356	27.2	64	8	June 2	June 8
None...........	1,592	278	14.	65	7	—— –	June 8

† Prepared according to directions in Mass. Agr. Exp. Sta. Bull. 179, pages 175-6, except that flakes were used instead of bars of soap.

Continued experimentation in 1923 in the orchard at the E
periment Station Farm and in the orchard at Conyers Far
Greenwich, substantiated the results in 1922 except for the u
of fish oil soap, the results in this case not appearing so favoral
as in 1922, and the foliage turning brown before the end of t
summer. Two different counts were made in both orchards, a
the results are shown in Tables 18 and 19.

TABLE 18—RESULTS OF SPRAYING AT STATION FARM.

EXAMINATION JUNE 21 AND 22, 1923.

Treatment Received	Date of Treatments	Condition of Leaves	No. Leaves Examined	Total No. Eggs Per 100 Leaves	Total No. Live Mites Per 100 Leaves	Total No. Cast Skins Per 100 Leaves
1. Lime-sulphur Nicotine Sulphate Lead Arsenate.. Kayso and Lime	May 11 May 29–31 June 14 June 26	Green	100	16	1	33
2. Lime-sulphur Lead Arsenate Kayso and Lime	"	Green	125	7	6	303
3. No treatment	.....	Green	100	606	190	306
EXAMINATION AUGUST 22, 1923.						
1. Lime-sulphur Nicotine Sulphate Lead Arsenate Kayso and Lime	.....	Green	25	54	8	572
2. Lime-sulphur Lead Arsenate Kayso and Lime	.....	Green	25	48	16	240
3. No treatment	.....	Slightly browned	10	12	10	13,580

TABLE 19—RESULTS OF SPRAYING AT CONYERS FARM.

EXAMINATION JUNE 12, 1923.

Treatment Received	Date of Treatments	Condition of Leaves	No. Leaves Examined	Total No. Eggs Per 100 Leaves	Total No. Live Mites Per 100 Leaves	Total No. Cast Skins Per 100 Leaves
1. Lime-sulphur 1—50	May 2 May 24 June 26	Green	225	3	2	130
2. Lime-sulphur followed by linseed oil emulsion	May 2 May 24 June 26	Green	100	39	61	71
3. Check, no treatment	.....	Turning brown	50	286	1,220	1,094
4. Lime-sulphur plus nicotine sul- phate	May 2 May 24 June 26	Green	160	3	6	178
5. Lime-sulphur plus Kayso and Sulphur	"	Green	210	11	26	227
6. Fish Oil Soap and Sulphur	"	Green	200	25	29	196

TABLE 19. RESULTS OF SPRAYING AT CONYERS FARM—*Continued.*

EXAMINATION AUGUST 2, 1923.

›atment ›eceived	Date of Treatments	Condition of Leaves	No Leaves Examined	Total No. Eggs Per 100 Leaves	Total No. Live Mites Per 100 Leaves	Total No. Cast Skins Per 100 Leaves	Total No. Dead Mite Per 100 Leaves
me-Sulphur	.....	Green	25	212	44	592	40
me-sulphur followed by oil emulsion	.....	Green	25	328	168	5,590	120
ieck, no ent	.....	Brown	25	20	25	18,300	4
me-sulphur iicotine sul-	.....	Green	25	140	44	3,476	16
me-sulphur ayso and r	.....	Green	25	32	8	1,562	0
ih oil soap ılphur	.....	Brown	25	1,648	544	10,300	280

Notes.

ıble 18. Insecticides used at the following strengths in all tests. Lime-Sulphu . to 50 gals.; nicotine sulphate .5 pint to 50 gals.; Lead arsenate 1.5 lbs. to 50 gals. .75 lb. to 50 gals.; hydrated lime 1.5 lbs. to 50 gals.

ıble 19. Insecticides used at following strengths. 2.—One per cent. linseed oi on. 4.—Lime-sulphur 1 gal. to 50 gals., nicotine sulphate 6 oz. to 50 gals. 5.—ulphur .5 gal. to 50 gals., Kayso .75 lbs. to 50 gals., sulphur 5 lbs. to 50 gals. 6.— fish oil soap 5 lbs. to 50 gals., sulphur 5 lbs. to 50 gals.

Cast skins left upon the leaves gave a reliable index of the efficiency of a spray in 1923, the total number found indicating how many mites had been present. Thus at the Experiment Station Farm, examination August 22, check trees showed twenty to fifty times as many cast skins per leaf as in the case of trees sprayed with lime-sulphur. At the Conyers orchard the check trees had from six to thirty times as many casts as could be found on trees sprayed with lime-sulphur. This seems to be more reliable than judging the foliage greenness, which may be affected by a number of causes. It will also be seen that no conspicuously greater control was obtained with lime-sulphur to which nicotine alone was added than with lime-sulphur combinations containing no nicotine. Lime-sulphur combinations thus far have not failed in a single instance under our observation to control the red mite successfully if applied according to spray calendar recommendations, especial attention being given to early summer sprays.

Mineral oil and linseed oil emulsions are very effective in killing mites—apparently more so than lime-sulphur if the count is made shortly after the spray is applied. They have given uniform results of this kind in every instance and there is no reason why linseed oil emulsion (or other safe spraying oil) cannot be used to advantage on trees unable to stand commercial lime-sulphur. For

apples their use seems to be needless in view of more efficient fungicidal effects of lime-sulphur. Soaps are likely to vary, and while their combination with sulphur may be effective at times, even this combination may fail to give good results. Probably their continued effect is dependent upon heat as with sulphur dusts already mentioned. A field test of three oil emulsions is shown in Table 20.

TABLE 20. EUROPEAN RED MITE CONTROL AT CONYERS ORCHARD.†

SPRAYED JUNE 25, 1923.

Exp. No.	Insecticide Used	Number Live Mites.	Number Dead.	Per Cent. Dead.	Possible Kill Per Cent.
1.	Sunoco spraying oil 1 part in 100 parts water...........	6	395	98.5	98.1
2.	Linseed oil emulsion 1 gallon linseed oil 1¼ lbs. Ivory soap 100 gallons water	30	177	85.5	82.5
3.	Schnarr's insecticide 1 part in 100 parts water...........	28	412	93.5	92.6
4.	None............	241	61	20.1	0.0

Notes.

Trees in experiments 1 and 3 sprayed with hand pump and rod, 2 with gun and power outfit.

SPRAY BURN RESULTING FROM SPRAYS CONTAINING LIME-SULPHUR.

The main objection to the use of lime-sulphur solution has been due to burning of the foliage. Severe spray burn was noticed in different sections of Connecticut in 1923 and notes upon the probable cause are timely. As the spray formula consists of several compounds, the following possibilities arise:

1. The cause of the spray burn may be the lime-sulphur solution—due to composition or strength.
2. It may be due to lead arsenate alone—due to high water soluble arsenic content.
3. It may be due to nicotine sulphate—especially combination products with other insecticides.
4. It may be due to a combination of all of these materials resulting in other compounds or altered original compounds which cause burning.
5. Weather conditions noticeably affect the degree of spray burn.
6. The particular variety may be susceptible to spray injury.

† Leaves collected immediately after treatment and examined the following day.

Considering these causes in order, with precautions necessary to avoid injury, it seems advisable:

1. To reduce the strength of lime-sulphur on tender varieties such as Baldwin from 1½ to 50 gallons to 1 to 50 or even 1 to 75 in the later applications.
2. To obtain a guarantee that the lead arsenate used shall contain no more than .75% of water soluble arsenic. If large quantities are purchased have the material analyzed for water soluble arsenic at the Experiment Station or elsewhere.
3. Omit nicotine sulphate unless aphids are present in the orchard.
4. Combine your sprays in the following order:

    1. Lead arsenate
    2. Nicotine sulphate
    3. Casein lime
    4. Lime-sulphur.

Do not allow sludge to collect in the bottom of the spray tank; clean frequently.

5. Do not spray when the temperature or humidity is high. It is best to stop when the temperature reaches 90 degrees.
6. Be particularly careful with Baldwin and other thin leaved varieties. If the trees continue to be burned, use formula[3] containing lime-sulphur, casein lime and sulphur as follows:

Water	100 gallons
Lime-sulphur	1 gallon
Finely ground sulphur	5–10 lbs.
Casein lime	1 lb.

Summary and Recommendations.

1. The European red mite passes the winter in the egg stage upon smaller twigs and branches. Eggs hatch in April or May at the time fruit buds are turning pink.
2. The incubation period of the summer egg varies from six to thirteen days, and the adult develops in five to ten days. The preoviposition period lasts from one to seven days, but eggs are usually laid within a few days after emergence. Adults lived six to nineteen days and adult females laid a total of sixteen to thirty-four eggs during their lives. Winter eggs are sometimes laid in August; usually however during September and early October. Winter eggs are dark red, summer eggs, brown.
3. This mite is easily distinguished from other species in adult and egg stage.
4. An infestation of 50 to 100 mites per leaf is sufficient to cause leaves of apple trees to turn brown. Baldwin is the variety most commonly injured.

5. Enemies become numerous in July and August and are often responsible for the disappearance of the red mite.
6. Dry weather in summer favors their development and a wet period with frequent showers keeps them in check.
7. A definite spray schedule should be adopted in orchards where mites are numerous.
8. Lime-sulphur delayed dormant spray is not effective because of the late hatching of the egg.
9. Miscible oils are effective dormant sprays, and with care are reasonably safe in orchard work. Fall sprays of miscible oil are apparently ineffective.
10. Lime-sulphur, summer strength, sprays should be applied early beginning with the pink spray, which should be followed by at least two others containing lime-sulphur, the latest being applied the last of June or first of July.
11. Nicotine sulphate is unnecessary in the spray mixture so far as mite control is concerned.
12. Soaps, miscible oils and linseed oil emulsion are very effective summer sprays, but needless and apparently less efficient in control of fungous diseases than lime-sulphur.
13. Care should be exercised in applications of lime-sulphur and the precautions noted on page 123 carefully observed.

Acknowledgments.

In the course of the work outlined in the present paper, several persons have aided materially. Dr. W. E. Britton, and Messrs. M. P. Zappe, B. H. Walden, E. M. Stoddard and G. E. Graham have given invaluable service. The use of orchards belonging to the Plant Brothers at Branford, S. T. Bradley of North Branford, F. N. Platt of Milford, as well as the Conyers orchard at Greenwich, managed by Messrs. G. A. Drew and H. B. Reed, has increased the scope of the work immeasurably. Thanks are due to all persons in charge of orchards, without whose aid orchard field work would have been impossible; and to those who have given personal service and advice throughout the period of these investigations.

Literature.

1. Caesar, L.
   1915. *In* Canadian Entomologist, 57-58.
2. DeLong, D. M.
   1923. Results of Spraying and Dusting for the Control of the Red Spider (*Paratetranychus pilosus*).
   In Journ. Econ. Ent. 16: 88-90.
3. de Ong, E. R.
   1922. The Control of Red Spider in Deciduous Orchards.
   Cal. Agr. Exp. Sta. Bull. 347.
4. Essig, E. O.
   1922. The European Red Mite.
   In Mo. Bul. Cal. State Dept. Agr. 11: 409-411.

5. Ewing, H. E.
1912. The Occurrence of the Citrus Red Spider *Tetranychus mytilaspidis* Riley on Stone and Citrus Fruit Trees in Oregon.
In Journ. Econ. Ent. 5: 414-415.

6. ....
1914. The Common Red Spider or Spider Mite.
Ore. Agr. Exp. Sta. Bul. 121.

7. Fernald, H. T. and Bourne, A. I.
1922. Injury to Foliage by Arsenical Sprays.
Mass. Agr. Exp. Sta. Bul. 207.

8. Flint, W. P.
1923. Shall we Change our Recommendations for San José Scale Control?
In Journ. Econ. Ent. 16: 209-212.

9. Frost, S. W.
1919. *In* Journ. Econ. Ent. 12: 407.

10. Garman, Philip.
1921. The European Red Mite, *Paratetranychus pilosus* Can. & Fanz., in Connecticut.
In Journ. Econ. Ent. 14: 355-359.

11. ....
1920. *In* Rept. Conn. State Entomologist, 184–189.
1921. " " " " 146–152.
1922. " " " " 333–338.

12. Hamilton, C. C.
1922. Univ. Md. Extension Service Information Card No. 6.

13. Houser, J. S.
1923. Proc. Fifty-sixth Ann. Meeting Ohio Sta. Hort. Soc., 56-59.

14. McGregor, E. A.
1919. The Red Spiders of America and a Few European Species Likely to be Introduced.
Proc. U. S. Nat. Mus. 56: 641-679.

15. Stratford, G.
1920. Control of Red Mite on Apple Trees.
In New Zealand Journal of Agriculture XX: 176-178.

16. Tragardh, Ivar.
1915. Bidrag Till Kannedomen Om Spinnkvalstren (Tetranychus Duf.).
Med. nir. 109, fr. Cent. f. fors, pa jordbr. Entom. avdel. n: r 20.

17. Quayle, H. J.
1912. Red Spiders and Mites of Citrus Trees.
Cal. Agr. Exp. Sta. Bul. 234.
1913. Some Natural Enemies of Spiders and Mites.
In Journ. Econ. Ent. 6: 86-88.

18. Vinal, Stuart C.
1917. The Greenhouse Red Spider Attacking Cucumbers and Methods for its Control.
Mass. Agr. Exp. Sta. Bul. 179.

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Better Forests for Connecticut

HENRY W. HICOCK

The Woodlot is a Farm Problem

Forestry Publication No. 14

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PRACTICAL SUGGESTIONS TO THE WOODLOT OWNER.

Plant idle or waste land with fast growing coniferous or softwood trees.

Improve inferior stands of young hardwoods by planting 300 to 500 coniferous trees per acre.

Improve the better hardwood stands by thinnings, so that cordwood and other low grade material may be by-products of the forest and the more valuable species may be left to grow to sawlog size.

Develop better methods for selling and utilizing woodlot products.

Change the present inequitable method of forest taxation which forces the forest crop to bear an annual tax thus lowering the net returns so that growing timber is often unprofitable.

Work for better protection from fire and other enemies of the forest.

Harvest the minor products of the forest, thus getting several crops from the same area.

THE FORESTRY SITUATION IN CONNECTICUT.

Use of Forest Products.

*Annual consumption of sawed lumber	350,000,000 Bd. Ft.
*Annual production of sawed lumber	65,000,000 Bd. Ft.
Ratio of consumption to production	5 to 1

The Forests of the State.

†Total land area of the state	3,085,000 acres.
Land in forest or suitable only for forest (estimated) at least	1,500,000 acres.
*Present annual production	65,000,000 Bd. Ft.
Annual per acre production on a basis of 1,500,000 acres	40 Bd. Ft.
Minimum yield per acre per year to be expected under reasonable management and protection	300 Bd. Ft.
Minimum annual yield to be expected on 1,500,000 acres	450,000,000 Bd. Ft.
Possible maximum yield per acre per year	1,000 Bd. Ft.
Possible maximum annual yield on 1,500,000 acres	1,500,000,000 Bd. Ft.

Annual Freight Bill

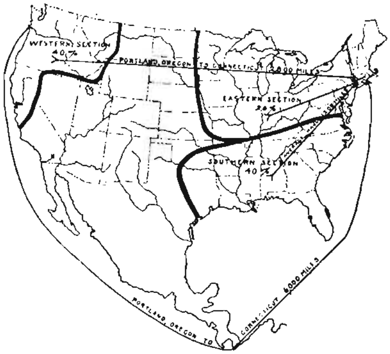
on lumber from other states	$3,000,000

*As reported by the U. S. Forest Service.

†As reported in the 1920 Census.

The Need for Forestry in Connecticut.

New England was one of the first forest regions in the United States to be exploited for lumber and at present is probably suffering more acutely from timber scarcity with resulting high prices than any other region. This condition has come about in a very natural manner. As timber becomes scarce in any section the bulk of the lumbermen move to some new region. When the supply in New England ran low the movement was to western New York, Pennsylvania and the Lake States. Later it was to the forests of the Southeastern States and more recently to the Pacific Coast.



Long Hauls Make Lumber Costly.

Each successive move has taken the major part of the industry farther from New England. *The result is that this region has been obliged not only to pay an increasingly higher freight rate due to a longer haul but also to compete for the products needed with regions which lie between it and the source of supply.*

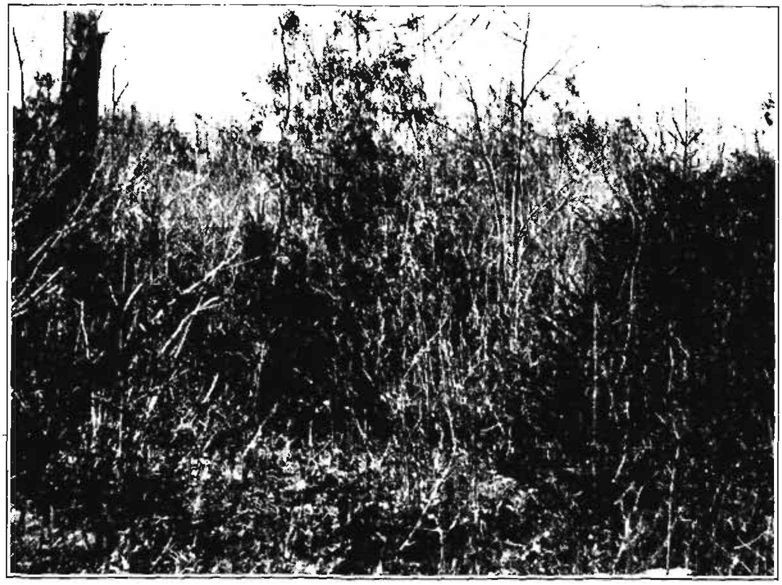
The Pacific Coast timber which is the only large remaining virgin stand in the country will, at the present rate of cut, last about 50 years. *When it is gone this country will be dependent chiefly on the current growth from lands that have been cut over.* Logging methods in virgin stands have been very wasteful with practically no effort to provide in any way for a new crop to replace the one removed. In addition much of the area already logged has been burned over one or more times. The result is that there are in the United States some 80,000,000 acres of barren waste which is producing nothing and a much larger area on which the productivity is not over 20% of what the land is capable of growing.

CLASSIFICATION OF FARM LAND BY COUNTIES.*

	Connecticut	Counties							
		Fairfield	Hartford	Litchfield	Middlesex	New Haven	New London	Tolland	Windham
Total land area, acres	3,085,000	404,000	466,000	592,000	236,000	386,000	422,000	259,000	320,000
Area in farms, acres	1,898,000	225,000	295,000	377,000	122,000	188,000	288,000	183,000	220,000
Per cent. of total area in farms	62	56	63	64	52	49	68	71	69
Area improved land in farms, acres	701,000	108,000	143,000	136,000	35,000	76,000	80,000	53,000	70,000
Area unimproved land in farms, acres	1,197,000	117,000	152,000	241,000	87,000	112,000	208,000	130,000	150,000
Area average farm, acres	84	58	62	124	87	70	105	93	99
Area improved land on average farm, acres	31	28	30	45	25	28	29	27	32
Area unimproved land on average farm, acres	53	30	32	79	62	42	76	66	67
Per cent. of unimproved land on average farm	63	52	52	64	71	60	72	71	68
Number of farms	22,600	3,900	4,700	3,000	1,400	2,700	2,700	2,000	2,200

*From the 1920 census.

If the United States must ultimately depend for timber on current growth rather than on the accumulated growth of centuries (virgin timber) the aim should be to divide up the country into several units, each practically self supporting with regard to timber. The result of such a division would be to lower transportation costs and stabilize prices. New England should form such a unit. There is enough non-agricultural land within its borders to produce timber in sufficient amounts and of suitable kinds for its industries. Northern New England is a forest region.



Conifers Increase the Yield on Hardwood Land.

It can produce much more timber than is needed locally and will probably always have a surplus to export to other districts. Its products are chiefly soft wood. Southern New England is an industrial region and consequently a big market for forest products. *It has enough non-agricultural land to produce a quantity of lumber sufficient for its needs but it cannot grow all the kinds required.* It must therefore import lumber but to offset this it should have an equal quantity to export in order to preserve the balance.

Connecticut is a part of southern New England and the remainder of this report will be devoted to its forest problems, with suggestions for the improvement of the forests, particularly the farmers' woodlots.

THE FORESTS OF CONNECTICUT.

The annual consumption of sawed lumber in Connecticut is approximately 350 million board feet and of this amount only 65 million board feet or *about one-fifth is produced within the state.*

The total land area of the state is 3,085,000 acres and of this at least one half, or 1,500,000 acres, may be classed as non-agricultural or forest land. On the assumption that the forest land area is 1,500,000 acres, *the present annual production per acre is only 40 board feet.* This is very low. *With reasonable care and protection 300 board feet per acre per year is the minimum that ought to be expected and the possible maximum might run as high as 1,000 board feet per acre annually.* On the basis of 1,500,000 acres, the total annual yield should be between 450 million and 1,500 million board feet.

These figures indicate a two-fold problem.—

1. **A land problem.** By better treatment and protection to make the poorer non-agricultural lands produce a reasonable crop, thereby raising their status from that of a doubtful asset or even a liability to that of a profit producing asset.

2. **A timber problem.** To produce annually within the state at least 450 million board feet of sawed products. This would make the state practically self supporting. Some timber would, of course, be imported to supply the need for kinds that cannot be grown here but to offset this there would be some native timber for export.

It may be noted from the table (page 134) that there are 1,187,000 acres, or 38% of the land area of the state, not in farms. It is not possible to determine definitely the present status of the land not in farms but it may be reasonably assumed that not less than 25% of it, or 300,000 acres, is forest land. This added to the 1,200,000 acres on farms makes 1,500,000 acres which is a conservative figure and agrees closely with the figure of 1,483,000 acres abtained by the forest survey of Connecticut in 1914.* It is quite possible that this estimate could be increased by including with the forest land, all pastures reverting to forest. This may or may not be correct. Furthermore it involves the question of proper utilization of land which beyond the scope of this report.

This table shows that 63% of the farm land of the state is unimproved. This figure varies with the several counties but in no case is it under 50%. Improved land is given in the census as "land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries and land occupied by buildings." Unimproved land constitutes the remainder of the farm and is chiefly woodland, brush land, waste land and swamp. This unimproved land is usually too poor to till and of a doubtful value for pasture.

*A Forest Survey of Connecticut by Albert E. Moss.

In general it is fit only to grow trees because they are not exacting in their soil requirements.

Obviously the forest problem is largely a farmers' problem since farmers as a class own the most woodland. For most of them the situation is an acute one because their woodlots, averaging in area more than one-half the farm, are in a very low state of productivity due to fire, ravages of various diseases and insects, indiscriminate cutting and general misuse. In fact, it is a question whether or not many woodlots are paying expenses (i.e., interest and taxes) to say nothing of showing a profit. *An industrial*

Thinning in a Young Hardwood Stand.

organization either improves a poor paying line or abandons it. The farmer must do likewise for he cannot continue indefinitely to make his tilled land support itself and the woodlot also. If the woodlot cannot be made to pay it should be abandoned, but in most cases this will not be necessary because with reasonable handling it will improve to a point where it will pay.

In improving the forest there should be three main objectives:—

1. To handle the present deciduous or hardwood forest for better quantity and quality production. Quantity may be increased by favoring fast growing species and by reducing the competition which is always so keen in natural stands. Quality may be improved by favoring the most valuable species and the best individuals. Both objects can be attained through systematic thinning.

2. To gradually introduce conifers into the hardwood stands. Most conifers grow faster and yield more per acre than hardwoods. Moreover 80% of all lumber used is softwood from coniferous trees.

3. To treat the forest as a source of repeated crops of timber capable of improvement, rather than a non-renewable resource to be exploited to its fullest extent and then abandoned. Field crops require weeding, thinning, protection from enemies and suitable treatment to assure reproduction. Forest crops require similar care, though not as intensively applied, to secure comparable results.

Some Suggestions to the Woodlot Owner.

1. Thin the young woodlot systematically thereby getting rid of the poorer species and unhealthy individuals, allowing the best specimens to develop without excessive competition. The final yield will be as large and of better quality than in an unthinned stand and the material taken out will more than pay for the operation.

2. Plant at least 1,000 conifers each year for timber production. The cost will be not over $15.00 and the area covered from one to two acres depending on whether the planting is in the open or in brush. The attention required by a plantation is relatively small.

3. Grow Christmas trees on old pastures on a ten year rotation. This is a better use of land than allowing it to grow up to grey birches and is far more profitable. Up to three thousand trees per acre can be used for this purpose.

4. Avoid selling timber by the lot. In most cases the buyer reaps an excessive profit, a part of which rightfully belongs to the owner.

5. Make use of the present forest tax law. The law is not ideal but it favors the forest owner far more than the town assessors. Work for a better tax law.

6. Keep domestic animals out of woodland as a general rule. A limited amount of grazing may do no harm but over-grazing is detrimental to the woodlot. The better plan is to fence off the amount needed for grazing and use it only.

7. Grow saw timber. Cordwood should be obtained from thinnings and not by skinning immature stands. This latter process puts the lowest value on all species whereas such species as hickory, ash, whitewood, and red oak will bring high prices if grown to saw-log size.

8. Market more of the minor products of the forest, as ferns, mountain laurel and maple sugar.

9. Look upon the woodlot as one of the resources of the farm and not as something to pay taxes on. Figure out just how profit-

able the woodlot is. If it is not paying taxes and other overhead charges and allowing the owner a fair return for his investment in land, try to find out where the trouble is and remedy it.

10. Cooperate with the Connecticut Forestry Association, an organization which is working to advance forestry in the state.

11. Consult the Foresters of the Connecticut Agricultural Experiment Stations, New Haven, and the Connecticut Agricultural College, Storrs.

Thinned Pine Plantation, 28 years old.

Benefits to be expected from the improvement of the forest.

1. To the owner.
    a. Winter employment for farm labor and teams.
    b. Full utilization of land, no unprofitable acres.
    c. Income more evenly distributed throughout the year.
    d. Greater farm value if the owner wishes to sell.
    e. Larger loans from the Federal Land Bank.
2. To the community.
    a. Plentiful domestic lumber with low freight rates.
    b. More woodworking plants resulting from an assured supply of materials. This means closer utilization and better prices for woodlot products.
    c. Better protection of water supplies.
    d. Increased value of the forests for recreation.

CONCLUSION.

There have been *three major causes* for the present low productivity of the forests of Connecticut and of the United States as a whole. These must be corrected before any real progress can take place. They are:—

1. **Forest Fires.** It is a reasonably safe statement that fire has been the greatest single factor in lowering the yield of our forests. At least two-thirds of all forest fires are caused by negligence or carelessness. This condition can best be handled by building up a strong public sentiment against the persons responsible.

2. **Inequitable taxation.** A woodland owner must carry his forest for several decades before he gets any returns. During the growing period the town assessors may and usually do raise his valuation several times. *This often forces the owner to cut sooner than he otherwise would.* This method of taxing woodland may be likened to taxing a corn crop four or five times during a season and at a higher valuation each time.

3. **Poor cultural practice,** both *in caring for the current crop and in failing to provide for future crops* as well as unnecessary waste in logging and milling.

The forest owner cannot be blamed directly for the evils resulting from fire and taxes except that he has endured the losses therefrom without attempting to relieve the situation. Better legislation and stricter enforcement of existing statutes are needed. Forest owners can get these things only by going after them and pulling together.

The evils arising from not using practical forestry methods in growing and harvesting the timber crop can be charged directly to the owner and can be corrected only by him. It is true that the financial inducements to use better methods have not been great but the same may be said of many other things that we undertake with the conviction that they are worth while. If our grandfathers had adopted reasonable methods in handling their woodlots we would not now be obliged to pay a dollar for the material for a pantry shelf. If we are content to continue to use their methods it will probably cost the next generation two dollars. Is this fair?

BULLETIN 254 JANUARY, 1924

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

Report of the Director

For the

Year Ending October 31, 1923

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

OFFICERS AND STAFF

January, 1924.

BOARD OF CONTROL.

His Excellency, Charles A. Templeton, *ex-officio*, *President.*

James H. Webb, *Vice-President*....................................Hamden
George A. Hopson, *Secretary*..............................Mount Carmel
Wm. L. Slate, Jr., *Director and Treasurer*.....................New Haven
Joseph W. Alsop..Avon
Charles R. Treat..Orange
Elijah Rogers..Southington
Edward C. Schneider...Middletown

STAFF.

E. H. Jenkins, Ph.D., *Director Emeritus.*

Administration.	W. L. Slate, Jr., B.Sc., *Director and Treasurer.* Miss L. M. Brautlecht, *Bookkeeper and Librarian.* Miss J. V. Berger, *Stenographer and Bookkeeper.* Miss Mary Bradley, *Secretary.* William Veitch, *In Charge of Buildings and Grounds.*
Chemistry. Analytical Laboratory.	E. M. Bailey, Ph.D., *Chemist in Charge.* R. E. Andrew, M.A., C. E. Shepard, Owen L. Nolan, Harry J. Fisher, A.B., *Assistant Chemists.* Frank C. Sheldon, *Laboratory Assistant.* V. L. Churchill, *Sampling Agent.* Miss Mabel Bacon, *Stenographer.*
Biochemical Laboratory.	T. B. Osborne, Ph.D., Sc.D., *Chemist in Charge.*
Botany.	G. P. Clinton, Sc.D., *Botanist in Charge.* E. M. Stoddard, B.S., *Pomologist.* Miss Florence A. McCormick, Ph.D., *Pathologist.* G. E. Graham, *General Assistant.* Mrs. W. W. Kelsey, *Secretary.*
Entomology.	W. E. Britton, Ph.D., *Entomologist in Charge; State Entomologist.* B. H. Walden, B.Agr., M. P. Zappe, B.S., Philip Garman, Ph.D., Roger B. Friend, B.S., *Assistant Entomologists.* John T. Ashworth, *Deputy in Charge of Gipsy Moth Work.* R. C. Botsford, *Deputy in Charge of Mosquito Elimination.* Miss Gladys M. Finley, *Stenographer.*
Forestry.	Walter O. Filley, *Forester in Charge.* A. E. Moss, M.F., *Assistant Forester.* H. W. Hicock, M.F., *Assistant Forester.* Miss Pauline A. Merchant, *Stenographer.*
Plant Breeding.	Donald F. Jones, S.D., *Geneticist in Charge.* P. C. Mangelsdorf, M.S., *Assistant.*
Soil Research.	M. F. Morgan, M.S., *Investigator.*
Tobacco Sub-station at Windsor.	C. M. Slagg, M.S., *in Charge.*

Report of the Director

For the Year Ending October 31, 1923

To the Board of Control of the Connecticut Agricultural Experiment Station:

For the first time it becomes my duty to prepare the annual report of the operations of the Station. By far the most important event of the year has been the resignation on July first of Dr. E. H. Jenkins, under whose guidance the Station has attained so enviable a reputation both at home and abroad. It seems fitting to include here an excerpt from the editorial pages of the Experiment Station Record for July of this year:

> "The entire active career of Dr. Jenkins is centered in a single institution. This is a remarkable fact when the number of changes in most of the stations during the early years is considered, and the extent to which the workers transferred from one institution to another. He went to the Connecticut State Station as assistant chemist in 1877, when it was transferred from Middletown to New Haven. This was after his graduation from Yale and return from a year's study at the University of Leipzig. He was one of the two chemists who with the director, Dr. S. W. Johnson, formed the entire staff of the station. He has been continuously in its service from that time to the close of June, a period of nearly forty-seven years. In 1883 he became vice-director, and on the retirement of Dr. Johnson in 1900 he succeeded him as director. Since the consolidation of the administrative control of the State and Storrs Stations in 1912, he has served as director of both, and has rendered a valuable service in coordinating their activities in such a way as to avoid needless duplication and make them better meet the needs of the State.
>
> Including his period as vice-director, Dr. Jenkins' executive duties have covered a span of forty years, while his entire period of service is not only the longest at a single institution of any worker now living but exceeds that of any surviving member of the station forces. To few men is the opportunity given for a comparable period in which to formulate and carry into execution plans for the consistent development and upbuilding of a research institution."

In assuming the duties laid down by Dr. Jenkins, I have a keen sense of the honor and responsibility which you have placed upon me and it is with great pleasure and gratitude that I record the constant readiness of Dr. Jenkins to advise and encourage and likewise the cordial and loyal support of the entire staff.

Since Dr. Jenkins' resignation did not take effect until July first, more than half of the year has been under his administration. This report, however, covers the entire station year ending October 31, 1923.

CHANGES IN STAFF

In addition to the changes in administration mentioned above, the following resignations and appointments have taken effect:

Resigned:

Mr. Samuel T. Sealy, Deputy in charge of Mosquito Elimination, April 1, 1923.

Mrs. Alta Moss Storrs, Secretary in the Analytical Laboratory, June 1, 1923.

Dr. George H. Chapman, In charge of Tobacco Sub-Station, August 1, 1923.

Appointed:

Mr. R. C. Botsford, Deputy in Charge of Mosquito Elimination, July 1, 1923.

Miss Mabel Bacon, Secretary in the Analytical Laboratory, June 1, 1923.

Prof. M. F. Morgan, M.S., Investigator in Soils, July 20, 1923.

Miss Mary E. Bradley, Secretary to the Director, August 1, 1923.

Mr. C. M. Slagg, M.S., In Charge of Tobacco Sub-Station, August 1, 1923.

PUBLICATIONS

The annual report of the Station for the year ending October 31, 1922 (507 pages), with the exception of 32 pages of reports by the treasurer and director and the index, consisted of the following **Bulletins**:

No. 240. Report on Food Products and Drugs (1922), Part I.
241. Fertilizer Report for 1922.
242. Report on Commercial Insecticides and Fungicides (1922).
243. Report of the Director for the Year Ending October 31, 1922.
244. Spray Calendar (1923).
245. Results of Dusting *versus* Spraying in Connecticut Apple and Peach Orchards in 1922.
246. The Apple and Thorn Skeletonizer.
247. Twenty-Second Report of the State Entomologist (1922).
248. Report on Food Products and Drugs (1922), Part II.
249. Report on Commercial Feeding Stuffs (1922).

The report also contains the First Report of the Tobacco Sub-Station at Windsor, Connecticut, and the following bulletins of the Sub-Station:

No. 1. Condensed Recommendations for the Control of Wildfire (January, 1922).

2. Wildfire of Tobacco in 1922 (January, 1923).
3. Experiments in the Curing and Fermentation of Connecticut Shade Tobacco (February, 1923).

Besides the above, the following **Circulars of Immediate Information** were published:

No. 19. Winter Pruning of Fruit Trees. (March 14, 1923.)
20. Dormant Sprays on Orchard Trees. (March 21, 1923.)
21. What are Good "Seed" Potatoes? (April 5, 1923.)
22. The Pink Spray for Apple Orchards. (May 1, 1923.)
23. Diseases Carried by Seed Potatoes. (May 1, 1923.)
24. The Calyx Spray for Apples, Pears and Quinces. (May 21, 1923.)
25. The European Corn Borer Quarantine. (May 28, 1923.)
26. The Apple and Thorn Skeletonizer. (August 15, 1923.)
27. Registration of Bees. (Sept. 15, 1923.)

Following is a list of **Journal papers** and other publications by staff members:

The Potency of Some Commercial Vitamine Preparations.
By E. M. Bailey. Read at a meeting of New England Food and Drug Control Officials, Portsmouth, N. H.

A Modified Test for Phthalates.
By R. E. Andrew. J. Ind. & Eng. Chem., 15, 8, 838. (Aug. 1923).

Quantitative Aspects of the Role of Vitamine B in Nutrition.
By T. B. Osborne and L. B. Mendel. Jour. Biol. Chem. (1922) LIV, pp. 739-752.

Eggs as a Source of Vitamin B.
By T. B. Osborne and L. B. Mendel. Jour. Am. Med. Assn. (1923) LXXX, pp. 302-303.

Kidney Hypertrophy Produced by Diets Unusually Rich in Protein.
By T. B. Osborne, L. B. Mendel, E. A. Park and D. Darrow. Proc. Soc. Exp. Biol. and Med. (1923) XX, pp. 452-453.

A Product of Mild Acid Hydrolysis of Wheat Gliadin.
By H. B. Vickery. Jour. Biol. Chem. (1923) LVI, pp. 415-428.

Ocular Manifestations of the Rat which Result from Deficiency of Vitamin A in the Diet.
By A. M. Yudkin. Jour. Am. Med. Assn. (1922), LXXIX, pp. 2206-2208.

Pathogenesis of the Ocular Lesions Produced by a Deficiency of Vitamin A.
By A. M. Yudkin and R. A. Lambert. Jour. Exp. Med. (1923) XXXVIII pp. 17-24.

Changes in the Paraocular Glands Accompanying the Ocular Lesions which Result from a Deficiency of Vitamine A.
By R. A. Lambert and A. M. Yudkin. Jour. Exp. Med. (1923) XXXVIII pp. 25-32.

Connecticut Vegetable Diseases in 1922.
By G. P. Clinton. Rept. Conn. Veg. Growers' Assn. (1922) pp. 69-74.

Connecticut Fruit Troubles in 1922.
By G. P. Clinton. Proc. Conn. Pom. Soc. (1922) pp. 10-13.

The Aleyrodidae and Coccidae of Connecticut.
By W. E. Britton. Conn. Geol. & Nat. Hist. Survey (June, 1923) Bulletin No. 34, 48 pp.

The Apple and Thorn Skeletonizer.
By W. E. Britton. Proc. 32nd Ann. Meeting Conn. Pom. Soc. (1923) p. 21.

Rapid Spread of the Apple and Thorn Skeletonizer, *Hemerophila pariana* Clerck.
By W. E. Britton. Jour. Econ. Ent. (April, 1923) Vol. 16, p 207.

The Gipsy Moth. Proceedings of Conference at Albany, N. Y. Nov. 16, 1922.
By W. E. Britton. N. Y. State Dept. Agric. Bull. 148 (Dec., 1922) p. 44.

Swarms of Aphids.
By W. E. Britton. Jour. Econ. Ent. (Aug. 1923), Vol. 16, p. 395.

Report of Committee on Injurious Insects.
By W. E. Britton. Conn. Pom. Soc. Proceedings (1923) p. 5.

The Arbor-Vitae Leaf-Miner.
By W. E. Britton. Tree Talk, Vol. 5, No. 2 (1923) p. 24.

The Work of the State Entomologist.
By W. E. Britton. Hartford Daily Courant (Oct. 21, 1923).

Insects Attacking Vegetable Crops in 1922.
By W. E. Britton. Rept. Conn. Veg. Growers' Assn. (1922) p. 83.

The Hemiptera of Connecticut.
By W. E. Britton *et al.* Conn. Geol. & Nat. Hist. Survey Bull. 34 (June, 1923), 807 pages, 169 figs., 20 plates.

Comparative Results of Spraying and Dusting on Apples and Peaches.
By M. P. Zappe and E. M. Stoddard. Proc. Conn. Pom. Soc. (1923) p. 30.

Work with the Control of the European Red Mite in 1922.
By Philip Garman. Proc. Conn. Pom. Soc. (1923), p. 13.

Notes on the Life History of *Clastoptera obtusa* and *Lepyronia quadrangularis*.
By Philip Garman. Annals Ent. Soc. of America, Vol. XVI (June, 1923) p. 153.

A Report on Double-Crossed Burr-Leaming Corn Grown in 1922.
By D. F. Jones. A mimeographed circular. (April, 1923).

PHYSICAL EQUIPMENT

During the year a number of pieces of much needed apparatus were purchased for the laboratories, including three special microscopes and a potentiometer. Two insectaries were erected and repairs made to the Station property on Huntington Street. Two fireproof safes for records and other office equipment were also added.

About 900 volumes were added to the library, which now includes over 10,900 volumes and an unusual equipment of scientific journals.

The inventory of June 1, 1923, shows:

Value of buildings and lands	$295,275.00
Value of contents	103,746.55
Total	$399,021.55

CONTROL AND SERVICE WORK

Since the founding of the Station, control and service work has been one of its functions. From time to time, duties of this nature have been added by the General Assembly, most of them

under special acts, and the administration of these has been maintained separate from the main operations or research proper.

Thus the Station administers entirely or in part the fertilizer, feed, food and drug, and insecticide control; the certification of Babcock glassware; the gipsy moth control; orchard and nursery inspection; apiary inspection; mosquito elimination and the white-pine blister-rust eradication; and the examination and certification of tree surgeons.

The chemical laboratories are at the service of residents of the State for the examination of fertilizers, feeding stuffs and drug products, when such information may be considered of public value and interest when published in the Station reports. Plant disease specimens, insects, weeds and similar material may also be sent to the Station for identification and advice on control. Questions regarding livestock management should usually be addressed to the Storrs Station, but on other matters this Station stands ready to render help and advice. Requests for analysis of drinking water should be addressed to the State Department of Health.

REPORTS OF DEPARTMENTS.

ANALYTICAL CHEMISTRY.

Dr. E. M. Bailey in charge.

1. During the year, in accordance with the provisions of the Statutes, about 860 samples of fertilizers have been examined, the results reported to the purchasers or others interested, and the complete data finally classified and prepared for publication.

2. Three hundred and seventy-one samples of commercial feeding stuffs and other fodder materials have been examined. This number includes analyses of certain field crops connected with experimental projects at this Station and at Storrs.

3. Over 2,500 samples of food products and drugs have been analyzed. While this is largely for purposes of control, many examinations have been made for the information of physicians, dietitians and others interested in dietetics; thus a number of unusual vegetable foods have been analyzed for Dr. W. A. Orton of the Bureau of Plant Industry, U. S. D. A., who is interested in new foods which may be utilized for the purpose of adding variety to the rather limited diet of diabetic patients.

4. A bulletin on insecticides and fungicides has been published which includes scattering analyses made in previous years and results of a rather complete survey of the market made in 1922. The new work of the past year has been chiefly upon samples

submitted by the departments of Entomology and Botany of this Station. About fifty samples have been examined, which number includes miscellaneous materials related to the subject.

5. Nearly 4,300 pieces of Babcock glassware have been inspected for accuracy of calibration and for conformity to other standard specifications.

Aside from essentially routine work, some time has been given to studies of methods and their applications. These include the determination of ammonia in eggs, the determination of nicotine in tobacco and tobacco products, the determination of fat in ice cream and the determination of starch and sugar in presence of gums and mucilages. An improved method for the detection of phthalates in alcoholic solutions has been devised and the details of the method have been published as noted in the list of publications.

Collaboration with the Association of Official Agricultural Chemists has been continued; also the laboratory has engaged in the coöperative programs of the American Oil Chemists Society and the F. S. Royster Guano Company, which involves the analysis of check cottonseed meal and mixed fertilizers.

The chemist in charge has assisted Dr. E. P. Joslin in the revision of his text on Treatment of Diabetes Mellitus by preparing a revision of tables of composition of normal foods and of so-called diabetic and special foods. He has continued to serve as a consultant to the Council on Pharmacy and Chemistry of the American Medical Association on subjects pertaining to diabetic and special foods; also as a member of the Joint Committee on Definitions and Standards for food products and drugs. Mr. Andrew has acted as referee on methods for analysis of tea for the Association of Official Agricultural Chemists.

BIOCHEMISTRY (PROTEIN RESEARCH)

Dr. T. B. Osborne in Charge.

The work of the department is supported in part by a grant from the Carnegie Institution of Washington, D.C. In the study of problems of nutrition, we are favored by the collaboration of Dr. L. B. Mendel of Yale University. The active projects may be discussed as follows:

1. Study of the proteins of green plants has been continued and the scope of these investigations extended to attempts to learn the nature of the nonprotein substances with which they are associated.

Methods have been developed whereby it is possible to obtain large quantities of the fluid present in the vacuoles of the cells apart from the semisolid cytoplasm and subsequently to obtain

the latter, likewise in relatively large quantities, free from the cell walls and other supporting structures of the plant.

Studies of these two parts of the plant cell are being made in the hope that they may contribute to the scanty knowledge which scientists now have respecting the chemistry of the cell. Investigations in this field are essential for further progress in the study of many of the problems of the nutrition of animals and plants, as well as of those of plant physiology and plant pathology.

2. The relation of the chemical constitution of the diet to the development of rickets has been studies in coöperation with Dr. Park of the Medical School of Yale University. A combination of purified food constituents has been discovered which has indicated the part played by each in the development of this disease. Work in this field is still in progress, the purpose being to determine more precisely the effect of the various constitutents of food on the development of bones.

3. Studies of the relation of vitamines to nutrition are being continued.

4. The feeding experiments, referred to in the report for last year, respecting the part played by proteins, carbohydrates and fats, have been continued and the results embodied in a paper now in press.

5. Studies of the effect on the eye of a deficiency in the diet of the fat-soluble vitamine have been continued in coöperation with Dr. A. M. Yudkin, ophthalmologist of the School of Medicine of Yale University.

6. The studies of the effect of diet on fertility, which last year were undertaken in collaboration with Dr. Mason of Professor Harrison's department of Yale University, have been continued with striking and important results, some of which will soon appear in print.

7. Further work on the relation of the chemical structure of the proteins to their nutritive value has been begun.

8. A new edition of "The Vegetable Proteins" has been prepared and the subject brought down to date. This volume summarizes a large part of the work done in this department during past years and also includes that done by others in this field of study.

BOTANY.

Dr. G. P. Clinton in charge.

The work of the department may be summarized as follows:

1. **Experiments on Fertilization of Peaches.** This problem has been continued without change. Nitrate of soda seems to give most satisfactory results.

2. **Mosaic of Plants.** An intensive study of mosaic diseases of plants, with Dr. McCormick, has been made. This included infection experiments out of doors and in the greenhouse; a critical and prolonged microscopic study of the leaves of infected tobacco, etc.; and a chemical study, with help of Dr. Bailey's department, of healthy and mosaic tobacco leaves. We believe we now know as much about this disease as any one, but the cause still remains a mystery.

3. **North American Ustilaginales.** A beginning has been made on the publication, as an addendum to this volume, of such new species, hosts and distributions of the smuts as have come to light since the former publication. This work has taken considerable time, and much remains yet to be done before its completion.

4. **Rusts of Connecticut.** In connection with W. R. Hunt, a graduate student in botany at Yale, a monograph of the Rusts of Connecticut has been started. Mr. Hunt took the material collected by Dr. Clinton during his twenty years' connection with the Station and prepared it for his master's degree. During the summer he was employed by the Station for two months on similar work. A special effort was made to add to these collections during the year. The material has now all been determined, and includes between 125 and 150 species represented by over one thousand specimens.

5. **Plant Disease Survey.** The plant disease survey of the State for the Station and the U. S. Department of Agriculture has been continued. Card indexes of all observed diseases, their prevalence, distribution, etc., have been made, and preliminary reports made to the government at various times during the summer. The final report covering all diseases is now being completed.

6. **Comparison of Dusts and Sprays on Apples, Peaches, Potatoes and Celery.** Most of the work is carried on jointly with the Entomology Department and includes studies of the effectiveness of various dusts and sprays as controls for all of the common pests of these crops. In the main, it is conducted at the Station farm at Mount Carmel, but some outside orchards are resorted to when larger areas are needed. The results with dust on apples were more favorable this year than formerly, probably because of the dry weather.

7. **Selection of Sweet Corn for Disease Control** has been continued at the farm of Charles R. Treat in Orange. An unfavorable season produced a poor seed crop.

8. **A Continuation of the Study of Thielavia basicola.** Forty-two one-ascospore cultures were obtained through the process of treating the ascospores with pepsin, thereby causing them to germinate. These ascospore strains were crossed with the

ordinary chlamydospore-endospore strains with the result that numerous perithecia were formed. Following a suggestion made by Prof. Thaxter of Harvard, an ascospore strain was crossed with several other fungi with the result that cross with Cladosporium produced perithecia as abundantly as with the chlamydospore-endospore strains of *Thielavia basicola.* This raises the question whether the production of perithecia with *Thielavia basicola* may not be due to the parasitism of the one fungus upon the other rather than the result of sexuality of the two strains. Crosses with other fungi will have to be made, particularly with *Thielaviopsis.*

During the year, 100 specimens of fungi and weeds sent in by various correspondents have been identified.

There have been added to the herbarium 656 specimens, mostly in exsiccati.

Several hundred specimens of fungi were collected in the State but not finally determined.

The testing of seed for residents of the State involved 463 germination and 30 purity tests.

ENTOMOLOGY.

Dr. W. E. Britton in charge.

Dr. Britton also holds the position of State Entomologist, which entails responsibility for considerable control and inspection work.

CONTROL.

1. During the year there were inspected 114 nurseries, 179 cases of imported nursery stock, 31 orchards and 725 apiaries. The Insect Pest fund was increased by the last General Assembly to $15,000 per year.

2. The Gipsy Moth work has continued unabated. No extensive spread occurred, but the constant efforts of a crew of twenty-five men were required to hold it in check. The U. S. Department of Agriculture is coöperating in this fight. The annual appropriation was increased to $50,000.

3. Mosquito Elimination was handicapped by the change of the Statute, throwing the entire expense of maintenance on the State, but the funds were not increased. The State stands in a way to lose much of its present investment in drainage works if funds for necessary repairs are not soon provided.

INVESTIGATION.

1. A study of the plum curculio on apple has been undertaken during the year. This is a serious pest in this region and there is much to be learned of its habits and control.

2. Further tests of paradichlorobenzene to control peach borer are showing promising results.

3. The dusting and spraying experiments mentioned under BOTANY were continued, chiefly to try out the new dust preparations.

4. Studies on the European red mite have been continued and a bulletin prepared by Dr. Garman, summarizing the results of four years.

5. The control of foul brood of bees is being studied in a small way. It is hoped that this can be made more active.

6. A study of the raspberry fruit worm, covering three years, has been completed and a bulletin prepared by Mr. Walden.

7. Dr. Garman has completed a monograph on the Dragonflies of Connecticut, to be published by the Connecticut Geological and Natural History Survey.

Dr. Britton organized and edited, and in part prepared, The Hemiptera of Connecticut, published during the year as Bulletin 34 of the Connecticut Geological and Natural History Survey.

FORESTRY.

Mr. W. O. Filley in charge.

The work of the Forestry Department is very largely on long-time projects and it is seldom that one can be considered completed. During the past twelve months, progress has been made on certain projects, but none have been brought to completion.

1. **Experimental Forest Plantations at Rainbow.** No planting was done during the year. Much needed cleaning of the older plantations was practically completed last spring, and the entire tract is in better shape than for several years past.

The necessary studies were completed for a progress report and guide to the plantations, which will be published during the coming winter.

2. **Experiments in Thinning White Pine at Shaker Station.** Measurements were taken in the late fall, and not completed in time for this report, but will be included in that of next year.

3. **Experiments in Thinning Hardwoods at Quassipaug Lake.** No measurements until 1927.

4. **Studies of White-Pine Needle Blight.** On account of heavy snows and bad roads, no attempt was made to make further study of conditions at Enfield. Casual observations throughout the State indicated considerable of the so-called needle blight following several hot dry days in June.

5. **Distribution of Planting Stock.** As in previous years, an effort was made to assure a supply of planting stock for Con-

necticut land owners at reasonable prices by placing an advance order with a commercial nursery. There were no transplants available, but 475,000 two-year seedlings were distributed on 85 orders.

6. **Woodlot at Mount Carmel Farm.** Aside from necessary freeing of planted stock and removal of some of the overwood, nothing has been done in the woodlot.

7. **Willow Culture at Mount Carmel Farm.** The two holts were continued, but one will be pulled up next spring. About 10,000 cuttings will be available for distribution, and an effort will be made to place them where they can be observed from time to time.

8. **Control of White-Pine Blister-Rust.** From May to October, 1923, a total of over 13,000 acres in Litchfield County was freed from wild ribes, about 286,000 bushes being pulled up. This work was all on a coöperative basis. The town of Canaan appropriated $500; citizens of Salisbury have promised to raise $3,500 for two years' work; and citizens of Cornwall had raised $1,750 the previous year. Four crews were therefore employed in these towns. The American Brass Company assumed the cost of labor for eradication in its pine plantations in the vicinity of Torrington, and the State furnished a foreman for two months. One land owner in Litchfield also assumed the labor cost for eradication in his pine lands, the State supplying a foreman for about two weeks.

Another season's work will be necessary in both Salisbury and Canaan. Cornwall is practically completed, although a few weeks' work will be necessary next spring. The State appropriation of $15,000 for the two-year period appears to be adequate when supplemented by the funds contributed by towns or individuals.

Educational work throughout the State has been continued in coöperation with the Bureau of Plant Industry. Three educational agents were employed during the year, but one resigned on August first to take a position elsewhere, and his successor has not yet been appointed. The pine areas in the northern part of the State have been pretty well covered; pine owners have been personally interviewed, and their holdings scouted for the rust. New infections have been located on pine in three towns outside of Litchfield County: Simsbury, Farmington and Ellington. These infections will be carefully watched and the owners urged to coöperate with the State in eradicating the Ribes. During the coming winter, scouting and educational work will be continued in the southern half of the State.

On the whole, the situation is encouraging, especially as studies made this fall indicate very little spread of the disease in those areas from which Ribes were eradicated from 1916 to 1921. The

problem is still one of cleaning up Litchfield County, as the isolated infections in other parts of the State are much more easily taken care of.

9. **State Park and Forest Commission.** This is really a project for the establishment of State parks and State forests, in which the Agricultural Experiment Station coöperates by allowing its forester to serve as a member of the Commission. As treasurer of the Commission and as a member of all its standing committees he is at present fairly active in determining the policy of the State regarding both State parks and State forests.

10. **Studies of Forest Plantations.** These have been carried on throughout the year by the Blister Rust agents, who are in a position to locate and report on all such plantations, in connection with their other work. It is hoped to complete this study in time to include the results in a bulletin on "Forest Planting", to be published during the coming year.

11. **Soil and Land Survey.** During the summer and fall of 1923, the Forestry Department has coöperated in a soil and land survey which was undertaken experimentally in the towns of Lebanon and New Milford. The assistant foresters, Mr. Moss and Mr. Hicock, have both been employed in this work and have helped to develop methods and technique of mapping surface cultures which may be applied to other parts of the State if the survey is continued.

The department is frequently called on to inspect and give advice on the management of woodland, and illustrated lectures on forestry are in great demand. The people of Connecticut have not as yet fully realized the importance of forestry in a State including so much non-tillable land. Educational work is therefore still necessary until the regular extension forces take it up.

GENETICS (PLANT BREEDING)

Dr. D. F. Jones in charge.

The investigations in this field are listed as follows:

1. The inheritance of characters in corn.
2. The effect of inbreeding and crossing in corn.
3. The improvement of naturally cross-fertilized plants by selection in self-fertilized lines.
4. Methods of improving the naturally self-fertilized tobacco plant.

Double-crossed Burr-Leaming corn has continued to give increased yields of grain as compared with the highest yielding varieties grown at the Experiment Station farm at Mount Carmel. This new kind of corn is the result of combining by cross-fertiliza-

tion four inbred strains derived from two varieties, Burr's White Dent and Leaming. The result is a hybrid type which gives a remarkably productive growth for the first year due largely to the fact that practically every plant makes a good ear. This yield is not maintained in the following years. Only crossed seed is recommended for planting. This seed is being produced in Connecticut and the amount of seed available is being increased as rapidly as possible.

Double-crossed Burr-Leaming requires from 120 to 140 days to ripen properly for husking. It is a large-growing variety which stands up well in the field and should not be planted too thickly. The yield of this corn in bushels of dry shelled grain per acre, compared with the five varieties which yielded the most in each of the five years tested, is as follows:

	1918	1919	1920	1921	1922
Double-crossed Burr-Leaming	116	88	55	95	63
Average of five highest-yielding varieties	82	64	47	81	54

Better strains from the same source are now being substituted for some of the weaker ones formerly used, with the expectation that the yield of Burr-Leaming corn will be increased and the production of the seed will be made easier.

Other methods of combining the inbred strains are being tried out with the aim of simplifying the production of hybrid seed.

A number of the best inbred strains, selected for five years from four of the highest-yielding Connecticut varieties of dent and flint corn, were tested the past season for the purpose of making a high-yielding, high-quality and earlier-ripening corn than Burr-Leaming, suitable for husking in nearly all parts of this State and for silage in northern New England.

Inbred strains of Evergreen and Golden Bantam sweet corn have been selected for canning purposes, and crosses between these strains are now being tested. It is expected that the uniform production, even size of ears and simultaneous ripening of practically all plants will make crossed corn even more valuable for canning purposes than for field corn.

The method of corn improvement, outlined above and spoken of as "selection in self-fertilized lines" is also being applied in a preliminary way to alfalfa and clover and to some of the small fruits. In the former, particular attention will be given to the production of a long-lived, winter-hardy alfalfa and a clover resistant to mildew. The discovery of a few red clover plants entirely free from mildew in a field badly infected gives encouragement that a mildew-free clover variety is possible.

Technical studies, of interest only to investigators, are being confined to the inheritance of disease resistance and of abnormal-

ities, with particular regard to sterility; the obtainment of complete homozygosity in a naturally cross-fertilized species; and the linkage of hereditary factors.

Round Tip tobacco, originated by this department, is rapidly increasing in popularity. Breeding work is being continued at the Tobacco Sub-Station with some of the other types of tobacco.

SOILS.

Mr. M. F. Morgan in charge.

A moderate increase in the State funds for maintenance made possible the undertaking of certain soil studies in which Dr. Jenkins had long been interested. These include certain problems of tobacco soils which are to be undertaken next summer. However, since the funds were not available until July 1, 1923, the present season was devoted to that other most pressing problem:

A Study of the Soil Resources of Connecticut.

Two areas, Lebanon and New Milford, were intensively studied from every possible angle, the data thus assembled forming the basis of studies planned this winter on methods and future program. So far the work gives promise of great usefulness to the State and to soil science.

TOBACCO SUB-STATION AT WINDSOR

Mr. C. M. Slagg in charge

During the 1923 session of the General Assembly, a bill was passed increasing the annual appropriation for the Tobacco Sub-Station from $5,000 to $10,000, thus providing adequate support for the work. An experimental tobacco barn, 32 by 128 feet, has been erected. This barn is divided by three inside partitions into four compartments, each of which is fitted with a different type of ventilation.

At the present time there is also in course of erection a main building, designed to include sorting and packing rooms, tobacco curing rooms, an office and a laboratory, with a small greenhouse adjoining. This building is being constructed and equipped jointly by The Connecticut Agricultural Experiment Station and the Connecticut Valley Tobacco Improvement Association.

On August 1, 1923, Dr. George H. Chapman resigned his position of Research Director and Secretary of the Connecticut Valley Tobacco Improvement Association and Director of the Tobacco Sub-Station. Mr. C. M. Slagg, of the Office of Tobacco Investigations of the United States Department of Agriculture, was secured by the Association to serve as their Research Director and Secre-

tary, and was later appointed "In charge of the Tobacco Station" on the Station staff.

Experiments under way at the Tobacco Station may be grouped under the following heads:

1. Fertilizer tests: Varying forms and amounts of nitrogen, phosphoric acid, potash, sulphur, magnesium and chlorine; a study of fractional applications of commercial fertilizer mixtures; and a comparison of cow and horse manure.

2. Varietal and strain test of Havana, Broadleaf, Shade Cuban and others.

3. Culture studies (Roundtip) 13 and 15 inch spacing in the row; the use of Thermogen paper; treatment of shade cloth in various ways to increase its utility.

4. Tobacco diseases, including the study of brown and black root-rots of tobacco, especially the effect of rotation.

On July 30, 1923, a field day was held. Approximately five hundred growers were in attendance to see the various field tests in progress.

The brown root-rot rotation plot tests, the magnesium, sulphur and chlorine plot test, and part of the variety and strain tests are coöperative with the Office of Tobacco Investigations, and the cloth preservative tests are in coöperation with the Bureau of Chemistry of the United States Department of Agriculture.

MOUNT CARMEL FIELD DAY

On August 7th a most successful field day was held at the Mount Carmel Farm. Among new and interesting features were a demonstration of garden tractors and a kindergarten for the care of children.

Respectfully submitted,

W. L. Slate, Jr.,
Director.

A List of Reports and Bulletins that are available to those who apply for them.

BULLETINS.

138. Commercial Eeeding Stuffs in the Connecticut Market.
141. Commercial Feeding Stuffs in the Connecticut Market.
155. The Elm Leaf Beetle.
156. Cotton Seed Meal as a Fertilizer.
160. Clover Seed in the Connecticut Market.
169. The Leopard Moth. (Summary.)
170. The Trade in Cotton Seed Meal.
177. The Apple Tree Tent Caterpiller.
180. Studies on the Tobacco Crop of Connecticut.
182. The Brown-Tail Moth.
186. The Gypsy Moth.
191. Tests of Soy Beans, 1915.
192. Observations on Alfalfa.
193. Tests of Soy Beans, 1916.
194. Manure from the Sea.
195. Insects Injuring Stored Food Products in Connecticut.
198. Domestic Supplies of Potash.
200. Report on Food and Drug Products, for 1917.
201. Food Fats and Oils.
202. An Experience in Keeping Poultry in the City.
203. Report of the Entomologist, for 1917.
204. Report on Commercial Fertilizers, for 1917.
206. Report on Commercial Feeding Stuffs, for 1917.
209. Report on Commercial Fertilizers, for 1918.
210. Report on Food and Drug Products, for 1918.
211. Report of Entomologist, for 1918.
212. Report on Commercial Feeding Stuffs, for 1918.
213. Condensed Milk, Malted Milk, Milk Powder.
214. Report of Botanist, for 1917 and 1918.
215. The Food Value of Milk.
217. Report on Commercial Fertilizers, for 1919.
218. Report of Entomologist, for 1919.
219. Report on Food and Drug Products, for 1919.
220. Report on Diabetic Foods.
221. Report on Commercial Feeding Stuffs, for 1919.
222. New or Unusual Plant Injuries and Diseases Found in Connecticut, 1916-1919.
223. Report on Commercial Fertilizers, 1920.
225. A Study of the Bulb Mite.
226. Report of the Entomologist, for 1920.

227. Report on Food and Drug Products, for 1920.
228. Connecticut Round Tip Tobacco.
229. Report on Commercial Feeding Stuffs for 1920.
230. The Grass-Feeding Frog-Hopper or Spittle-Bug.
231. Report of the Tree Protection Examining Board.
232. Report of the Director for the Year ending October 31, 1921.
233. Report on Commercial Fertilizers, for 1921.
236. Report on Food and Drug Products, for 1921.
237. Control of White-Pine Blister Rust in Connecticut.
238. Report on Commercial Feeding Stuffs, for 1921.
239. Wildfire of Tobacco in Connecticut.
240. Commercial Vitamine Preparations.
241. Report on Commercial Fertilizers, for 1922.
242. Report on Commercial Insecticides and Fungicides, 1922.
243. Report of the Director for the year ending Oct. 31, 1922.
245. Results of Dusting *vs.* Spraying in Connecticut Apple and Peach Orchards in 1922.
246. The Apple and Thorn Skeletonizer.
247. Report of Entomologist, for 1922.
248. Report on Food and Drug Products, for 1922.
249. Report on Commercial Feeding Stuffs, for 1922.
250. Report on Commercial Fertilizers, for 1923.
251. The Raspberry Fruit Worm.
252. The European Red Mite.
253. Better Forests for Connecticut.
254. Report of the Director for the year ending Oct. 31, 1923.

REPORTS.

Beginning with the year 1877 and ending with 1916 the Station issued Annual Reports. Of these the following are out of print: 1877-1880 inclusive, 1882, 1883, 1885, 1886, 1887, 1889-1892 inclusive, 1895-1906* inclusive.

Commencing with the year 1917, the annual reports include all regular bulletins; they are issued in parts and each part bears a bulletin number.

*Of some other reports the Station has but a limited number, which are reserved to complete library sets.

BULLETIN 255 FEBRUARY, 1924

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

The Twenty-Eighth Report on Food Products and the Sixteenth Report on Drug Products

1923

E. M. BAILEY

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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February, 1924.

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Soil Research	M. F. Morgan, M.S., *Investigator.*
Tobacco Sub-station	C. M. Slagg, M.S., *in Charge.*

CONTENTS AND SUMMARY.

Materials	Page	Sampled by, or at request of: Station Agent	Dairy and Food Commissioner	Individuals	Total	Adulterated, below standard or otherwise illegal
FOODS.						
ıtary Pastes	165	10	...	...	10	...
' Products	169	13	...	...	13	...
ıated Beverages	170	...	101	...	101	17
	171	...	...	1	1	...
	171	...	...	1	1	...
ic and Special Foods:						
ımmercial, etc	172	70	...	...	70	...
ıtural	180	33	...	...	33	...
	185	9	6	...	15	5
ıd Oils:						
ıtter	188	...	5	...	5	5
ıcoanut Fat	188	...	...	1	1	...
ıoking Fats	188	7	1	...	8	...
ive Oil	188	1	6	...	7	...
	189	18	...	...	18	...
	189	...	...	1	1	...
	190	...	...	1	1	...
ıam	190	...	339	2	341	5
ıd Milk Products:						
arket Milk	193	...	1228	131	1359	522*
/aporated Milk	193	23	1	3	27	2
/aporated Skimmed Milk	193	1	...	...	1	...
/eetened Condensed Milk	197	...	...	1	1	...
ıocolate-Milk	197	2	...	...	2	...
ıman Milk	199	...	...	16	16	...
ınd Meat Products:						
ımburg Steak	199	...	59	...	59	15
Preservative for	200	...	1	...	1	...
ırk Sausage	200	...	26	...	26	9
ankfurts	200	...	49	...	49	23
Color for	202	...	1	...	1	...
	203	23	...	...	23	2
Dressing	204	28	...	...	28	...
, etc	208	3	...	...	3	...
r	208	...	6	7	13	3
aneous	208	...	...	18	18	...
Total	...	241	1829	183	2253	603

*ncludes 333 samples "below standard" only.

Materials	Page	Sampled by, or at request of: Station Agent	Dairy and Food Commissioner	Individuals	Total
DRUGS.					
U. S. P. and N. F. Drugs:					
Ammonium Acetate, Solution of	209	...	16	...	16
Bismuth, Glycerite of	209	...	2	...	2
Citrated Caffeine	209	...	16	...	16
Ginger, Tincture of	210	...	1	...	1
Hydrobromic Acid, Diluted	210	...	3	...	3
Hypophosphorous Acid, Diluted	210	...	1	...	1
Iodine, Tincture of	210	4	76	...	80
Magnesia, Citrate of	211	...	1	...	1
Magnesia, Milk of	211	1	43	...	44
Nitrous Ether, Spirit of	212	...	48	...	48
Potassium Hydroxide, Solution of	213	...	5	...	5
Sodium Hydroxide, Solution of	213	...	3	...	3
Witch Hazel Water	213	11	41	...	52
Proprietary Preparations	214	3	...	...	3
Miscellaneous:					
Household Ammonia	216	24	...	...	24
Powdered Ammonia	216	1	...	...	1
Unclassified	217	5	...	...	5
Total	...	**49**	**256**	...	**305**
Total, Foods and Drugs	...	**290**	**2085**	**183**	**2558**
Babcock Glassware	218	...	...	...	4495

The Twenty-eighth Report on Food Products and Sixteenth Report on Drug Products

1923

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This report summarizes the examinations which have been made of foods and drugs during the past year. Much of the work has been required by the Dairy and Food Commissioner for the immediate purpose of food and drug control, but some of it, notably the examinations of alimentary pastes, eggs, table salt, salad dressings and evaporated milk, has been upon samples collected by our Station agent. A considerable number of so-called diabetic and special foods and of vegetable foods of particular interest to diabetics, have been analyzed. Special attention has been given to some changes taking place in eggs during holding, particularly with reference to ammonia content; and to the lipoid phosphorous content of commercial flours and of certain egg-flour mixtures.

The writer has prepared a revision of tables of composition of diabetic and special foods and of normal foods for the third edition of Dr. Joslin's text on Treatment of Diabetes Mellitus; and has also collaborated with the Director of this Station and the Dairy and Food Commissioner in revising the Rules and Regulations pertaining to the Food and Drug Law.

Acknowledgment is made to Messrs. Andrew, Shepard, Nolan and Fisher for their efficient cooperation; to Mrs. Storrs for painstaking work in connection with the preparation of the tables of composition of foods for Dr. Joslin's text; and to Miss Bacon for assistance in preparing this and other reports for publication.

I. FOODS.

ALIMENTARY PASTES.

Egg Noodles, Etc.

METHODS.

The evaluation of egg noodles with reference to the proportion of eggs or egg material which they contain has generally been based upon the amount of fat and the amount of alcohol-soluble phosphoric acid (P_2O_5), in the product. Fat has been determined by

continuous extraction with dry ether and alcohol-soluble phosphoric acid (lecithin phosphoric acid), by the method as described by Juckenack.[1] By these methods flour of average composition yields about 0.66 per cent. of ether extract and 0.0225 per cent. of alcohol-soluble phosphoric acid. The addition of 1 egg to a pound of flour increases the ether extract to about twice the amount in the flour and considerably more than doubles the alcohol-soluble phosphoric acid (0.0513). These figures are based on the water-free material. Judging by these data noodles containing less than 0.04 or 0.05 per cent. of alcohol-soluble phosphoric acid do not contain appreciable quantities of whole egg material.

More recent methods of determining so-called lecithin phosphoric acid have been based upon adaptations of the Roese-Gottlieb method for the determination of fat and the estimation of phosphoric acid in the fatty residue so obtained. The methods of Jacobs and Rask, as stated by Lourie,[2] Rask and Phelps[3] and of Hertwig[4] are the chief methods of this type. The two first named make use of an alkaline extraction while in the last named procedure the extraction is effected in a neutral medium. All of these methods give higher figures for fat and for lecithin phosphoric acid both in flour and in noodles than is obtained by the Juckenack method. It should be understood, however, that the fatty residue as obtained by alcohol-ether extraction may contain many other substances than neutral fats, such as phosphatides, phytósterol, pigments, etc., and Rask and Phelps suggest the term lipoid phosphoric acid as more accurately descriptive of this alcohol-ether-soluble phosphoric acid than the term lecithin phosphoric acid.

Whatever the method used, the magnitude of the figures obtained for crude fat and for alcohol-soluble or alcohol-ether-soluble phosphoric acid are not of determining importance so long as the results by the different methods are referred each to its corresponding basis of comparison, i.e., the figures obtained by the particular method upon the basic materials. Hertwig has called attention to the fact that there may be a decrease in lipoid phosphoric acid as noodles age and probably also during the manufacturing process and suggests that results for this constituent be increased by .1 before calculating egg solids in the product examined.

Hertwig gives comparative figures for lipoids (crude fat), and for lipoid phosphoric acid by the neutral extraction and the alkaline extraction methods, and for lecithin phosphoric acid by the Juckenack method as applied to flour and noodles. The figures are of interest and are as follows:

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[1] Ztschr. f. Unters. Nahr. und Genuss., **3**, 13. 1900.
[2] Jour. Assoc. Official Agr. Chemists, **6**, 11. 1922.
[3] Cited by Hertwig. Ibid. **7**, 92. 1923.
[4] Ibid. **7**, 92. 1923.

TABLE I. COMPARATIVE RESULTS FOR LIPOID PHOSPHORIC ACID AND LECITHIN PHOSPHORIC ACID.

(*Hertwig.*)

Substance	Alcohol-ether, Neutral extraction method		Alcohol-ether, Alkaline extraction method		Alcohol extraction, Juckenack method
	Lipoids	Lipoid-P_2O_5	Lipoids	Lipoid-P_2O_5	Lecithin-P_2O_5
	%	%	%	%	%
Flour (a)......	2.13	0.0531	1.84	0.0401	0.0293
Flour (b)......	2.07	0.0461	1.82	0.0473	......
Noodles (c)....	4.13	0.0877	3.79	0.0765	0.0613

Hertwig recommends the neutral method of extraction in order to avoid possible decomposition of lipoids by acid or alkaline media.

PRELIMINARY TRIALS WITH EGG-FLOUR MIXTURES.

Without trying to simulate the process used in the manufacture of noodles the following trials were made with egg-flour mixtures using the method of Jacobs and Rask for determining alcohol-ether-soluble phosphoric acid as suggested by Lourie.

The flour used contained, on the moisture-free basis, protein (N x 6.25), 10.84 per cent.; alcohol-ether extract 1.71 per cent.; alcohol-ether-soluble phosphoric acid 0.041 per cent. Eggs in the proportion of one, two and three to a pound of egg-flour mixture were added and the mixtures dried at low temperature until they contained from 5 to 10 per cent. of moisture after which the preparations were ground and analyzed. The results obtained are as follows:

TABLE II. ANALYSES OF EGG-FLOUR MIXTURES, DRY BASIS.

Material	Ash	Protein, (N. x 6.25)	Lipoids, (Alcohol-ether extract)	Lipoid-P_2O_5
	%	%	%	%
Flour...........	....	10.84	1.71	0.041
One egg per lb. mixture.......	0.63	11.84	3.21	0.082
Two eggs per lb. mixture.......	0.73	13.30	4.70	0.117
Three eggs per lb. mixture.......	0.81	14.84	5.92	0.151

The egg solids in the eggs used in the above mixture averaged 13.8 grams per egg. Assuming 1.38 per cent. of lipoid

P_2O_5 in egg solids[1] the amount of lipoid-P_2O_5 we should expect to find in the mixture can be approximated as follows:

1 egg—13.8 gms. solids x 1.38 per cent. . .	0.190 gm. lipoid-P_2O_5
Flour—439.2 gms. (dry) x 0.041 per cent	0.180 gm. lipoid-P_2O_5
Mixture—453.0 gms.	0.370 gm. lipoid-P_2O_5
Per cent. lipoid-P_2O_5 calculated.	0.082
Per cent. lipoid-P_2O_5 found	0.082

Similarly for two eggs per lb. of mixture we find 0.117 per cent. whereas the calculated amount is 0.122 per cent.; and for three eggs per lb. of mixture 0.151 per cent. instead of the calculated amount of 0.163 per cent. The percentage recovery is lower for greater amounts of eggs; in the case of three eggs per lb. of mixture (about 9 per cent. of egg solids), the recovery was about 92 per cent. Calculating the amount of egg solids in these mixtures according to the formula suggested by Lourie[2], thus,

$$\frac{(A - 0.041) \times 100}{1.38 - 0.041} = x$$

in which x = the per cent. of egg solids in the sample, *A* = the per cent. of lipoid-P_2O_5 in the sample and 0.041 = the per cent. of lipoid-P_2O_5 in the flour used in these trials, the following comparisons may be made:

	Egg solids used	Egg solids, estimated from lipoid-P_2O_5, found
	%	%
1 egg mixture.	3.04	3.08
2 " "	6.08	5.70
3 " "	9.12	8.23

COMMERCIAL NOODLES, ETC.

Six samples of commercial noodles and one sample of macaroni were examined and the results are given in Table III.

TABLE III. ANALYSES OF ALIMENTARY PASTES.

No.	Material	Moisture	Ash	Protein, (Nx6.25)	Crude fat, (alcohol-ether extract)	Nitrogen-free extract and fiber	Lipoid-P_2O_5	Lipoid-P_2O_5, water-free basis
	Noodles	%	%	%	%	%	%	%
20201	Anger's.	9.28	0.89	15.69	3.40	70.74	0.065	0.071
20211	A. & P.	8.13	0.65	14.25	3.98	72.99	0.197	0.214
20205	Freihofer's. .	9.25	0.92	16.56	4.39	68.88	0.092	0.102
20194	Meuller's. . .	9.18	0.78	13.56	3.70	72.78	0.080	0.088
20206	Quaker.	8.92	2.01	15.88	4.35	68.84	0.075	0.082
20213	Warner's. . .	9.30	1.17	16.75	4.29	68.49	0.076	0.084
	Macaroni.							
20214	Warner's. . .	10.45	0.95	13.88	1.90	72.82	0.047	0.052

[1] Jour. Assoc. Official Agr. Chemists, **6**, 11. 1922.
[2] Ibid., **6**, 11. 1922.

According to Lourie's formula noodles containing 5 per cent. of egg solids would show a lipoid-P_2O_5 content of about 0.121 per cent. Apparently, however, allowance should be made for the possible use of flour of less alcohol-ether-soluble phosphoric acid content than 0.0548 and also for the fact that the recovery of lipoid-P_2O_5 is not complete particularly, as noted by Hertwig, in products that are not of recent manufacture.

If allowance is made for flour containing as little as 0.041 per cent. of lipoid-P_2O_5 and for only 90 per cent. recovery of the lipoid-P_2O_5 present in the freshly made noodles, a product containing 0.097 per cent. lipoid-P_2O_5 would represent a formula calling for 5 per cent. of egg solids. Two of the samples examined exceeded this amount and four did not, although three of them approximated it more or less closely. Whether the egg solids represent whole egg or merely egg yolk cannot be deduced from the lipoid-P_2O_5 content alone. Hertwig has pointed out that the ratio of lipoid-P_2O_5 to alcohol precipitable nitrogen is a useful criterion for this purpose.

BAKERY PRODUCTS.

CAKES.

A number of bakery products, all yellow cakes, were examined for evidence of eggs and for artificial colors. Flour and eggs, or egg products, contribute all, or essentially all, of the phosphatid or lipoid phosphorus in this class of foods. Milk and shortening materials which consist of, or contain, milk constituents (butter and the margarines), may contribute some phosphorus of the phosphatid type in those products in which they are used but the amount will be relatively small.

In the samples of pastry examined lipoid phosphoric acid was determined in addition to the usual proximate constituents. "Fat" is the alcohol-ether extract upon which the lipoid phosphorus was determined and not "fat" in the generally accepted sense of "ether extract." For comparison in the case of sponge cake, two experimental cakes were made using the same recipe but with varying proportions of eggs. These are designated in the table of analyses as "home made."

TABLE IV. ANALYSES OF BAKERY PRODUCTS.

No.	Material	Moisture	Ash	Protein, (N x 6.25)	Crude fat, (alc-ether extract)	N-free extract and fiber	Lipoid-P_2O_5
	Sponge Cake	%	%	%	%	%	%
20649	Home made (2 eggs)....	23.44	2.41[1]	6.68	3.78	63.69	0.069
20650	Home made (4 eggs)....	26.31	1.49	7.89	6.32	57.99	0.133
20207	Bakery.......	23.85	0.80	10.69	11.25	53.41	0.226
20208	Bakery.......	19.91	1.86	6.59	8.20	63.44	0.107
20209	Bakery.......	27.55	1.42	8.18	5.51	57.34	0.131

[1] More baking powder used than in 20650.

TABLE IV. ANALYSES OF BAKERY PRODUCTS—*Concluded.*

No.	Material	Moisture	Ash	Protein, (N x 6.25)	Crude fat, (alc-ether extract)	N-free extract and fiber	Lipoid-P_2O_5
	Sponge Cake	%	%	%	%	%	%
20210	Bakery	18.85	2.11	7.97	5.71	65.36	0.139
20212	Bakery	18.75	1.39	8.35	10.60	60.91	0.116
20217	Bakery	42.45	0.54	5.03	3.57	48.41	0.060
	Cup Cakes						
20216	Bakery	20.66	1.42	6.00	14.38	57.54	0.034
20219	Bakery	18.98	1.64	5.65	23.44	50.29	0.053
	Plain Cake						
20218	Bakery	20.02	0.71	7.00	6.06	66.21	0.087
	"Cream" Puffs (Custard)						
20215	Bakery	57.03	0.61	5.63	14.02	22.71	0.067
20220	Bakery	58.34	0.98	6.27	88.77	25.64	0.079

No artificial color was found in any of the samples and the lipoid phosphorous content would indicate appreciable or substantial amounts of eggs or egg material. In general the cakes contained from 20 to 25 per cent. of moisture. Three approached or exceeded 50 per cent. of moisture and the lipoid phosphorous content is correspondingly low in these samples. Cup cakes showed the lowest percentage of this type of phosphorus.

CARBONATED BEVERAGES.

One hundred and one samples of carbonated beverages have been examined for the Dairy and Food Commissioner of which sixteen were found to contain saccharin and one contained preservative which was not declared on the label.

The inspection of this class of products is carried out largely under the provisions of a special act[1] which makes the use of saccharin illegal and which further provides that establishments bottling water and non-alcoholic beverages shall be licensed and that such license shall be issued only when conditions of cleanliness and general sanitation are satisfactory to the Dairy and Food Commissioner. Cleanliness in the preparation and distribution of food products is an item of the utmost importance and the results obtained from the operation of this law have been most gratifying.[2]

Adulterated or otherwise illegal samples are given in Table V.

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[1] Public Acts of 1921, Chapt. 159.

[2] Twenty-fourth Report of the Dairy and Food Commissioner, Public Document No. 32.

TABLE V. CARBONATED BEVERAGES ADULTERATED OR OTHERWISE ILLEGA

D. C. No.	Sampled at		Manufacturer	Remark
24366	*E. Portchester,*	Andrew Esposito	H. Dehmer Co. Inc.	Contains sa
24367		Louis P. Wellner	H. Dehmer Co. Inc.	Contains sa
24688		Andrew Esposito	H. Dehmer Co. Inc.	Contains sa
24689		Rocco Dattola	Silver Bot. Wks.	Contains sa
24690		Zachria Pessy	Atlantic Bot. Wks.	Contains sa
24372	*Greenwich,*	Hannah Hassan	H. Dehmer Co. Inc.	Contains sa
24373		Joseph Curtis	Atlantic Bot. Wks.	Contains sa
24374		George Matthews	H. Dehmer Co. Inc.	Contains sa
24375		George Matthews	H. Dehmer Co. Inc.	Contains sa
24376		Edward Dulmba	H. Dehmer Co. Inc.	Contains sa
24377		Edward Dulmba	H. Dehmer Co. Inc.	Contains sa
26026		P. Schinto	Silver Bot. Wks.	Contains sa
26000	*New Haven,*	B. Roklen & H. Abert	Own make	Contains sa
26744		Vincent Limauro	Own make	Contains sa
26745		Vincent Limauro	Own make	Contains sa
26746		Vincent Limauro	Own make	Contains sa
26048	*Willimantic,*	Thread City Bot. Wks.	Own make	Preservative not c

COCOA.

One sample of cocoa was submitted by Miss E. F. Packer, secretary of the Hartford Tuberculosis Society.

It was examined as follows:

Moisture 3.87 per cent.; ash 4.84 per cent.; protein (N x 6.25), 24.63 per cent. (not corrected for the nitrogen of alkaloids); fiber 4.49 per cent.; carbohydrates, by difference, 42.29 per cent.; fat 19.88 per cent.

Formerly cocoa contained more fat than many brands now show. This is because of the increased demand for cocoa to be used in various beverages where the cacao flavor is chiefly desired as, for example, in soda fountain and other beverages. So-called "breakfast" cocoa should contain 22 per cent. or more of fat.

CASEIN.

Analyses of a number of casein preparations designed for clinical purposes were examined and reported in a previous bulletin.[1] One sample, **21431**, was examined during the past year. It was made by the Harris Laboratories, Tuckahoe, N. Y., and offered for clinical purposes and for use in feeding trials in nutritional investigations.

The analysis is as follows:[2]

Moisture 10.73 per cent.; ash 0.59 per cent.; calcium trace; nitrogen 13.6 per cent. (equivalent to 87.09 per cent. casein); fat 0.20 per cent.; moisture fat and ash-free material 88.48; difference between casein and moisture, fat and ash-free material 1.39 per cent.; undetermined 1.39 per cent.; nitrogen on moisture-free basis 15.30 per cent.

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[1] Conn. Exp. Sta., Bull. 236, p. 233, 1921.

[2] Methods as given in New and Non-official Remedies, Am. Med. Assoc. 1923

DIABETIC AND SPECIAL FOODS.

Commercial and Manufactured Products.

A considerable number of brands of so-called diabetic and special foods have been examined during the past year. The foods of foreign manufacture were obtained chiefly through the courtesy of Mr. Benjamin Baruch of New York who secured them in England. The samples which he submitted were carefully labeled and original packages were furnished wherever possible.

COMMENTS UPON ANALYSES.

Flours and Meals. The official definition and standard for gluten flour is as follows:[1]

"Gluten flour is the clean, sound product made from wheat flour by the removal of a large part of the starch, and contains not more than ten per cent. (10%) of moisture, and, calculated on the water-free basis, not less than seven and one-tenth per cent. (7.1%) of nitrogen, not more than fifty-six per cent. (56%) of nitrogen-free extract (using the protein factor 5.7), and not more than forty-four per cent. (44%) of starch (as determined by the diastase method).

The gluten flours examined conform to these requirements but it should be emphasized that the use of such flours, or of any so-called diabetic food, should be governed entirely by the tolerance of the patient. Analyses are a guide to the physician in determining this factor in each case.

Ground gluten of standard quality should contain, on the moisture-free basis, twice as much nitrogen (14.2) per cent., and much less starch (not over 5.5 per cent.) than gluten flour. Compared with these specifications *Special Gluten*, **20829**, was about 0.6 per cent. low in nitrogen and exceeded the limit of starch.

The sample of *Cellulose Flour* from corncobs was submitted by Dr. Orton who explains that it is obtained after the cobs have been treated to remove starch and sugar for the manufacture of adhesives and furfural. It is used in the diabetic diet as a component of muffins, cookies, etc. *Cellu flour*, which we have discussed in a previous report,[2] is the same sort of material derived from other sources.

Sample **21559** was submitted for an opinion as to its suitability for diabetics. It is plain wheat flour of average composition.

Bakery Products. The analyses show that the products of Callard & Co. are generally high in protein and fat and low in carbohydrate, particularly the more available carbohydrate, i. e., starch and sugar. Many of the other products in this group show considerable or large amounts of starch. However, since the metabolism of protein may result in the production of con-

[1] Circ. 136, U. S. Dept. Agr., Office of Secretary.
[2] Conn. Exp. Sta. Bull. 227, p. 230.

siderable and varying amounts of sugar, a low starch, if accompanied by a very high protein, is not an unqualified advantage.

Plasmon is the name adopted by the Plasmon Co., Ltd., London, for their preparation of milk protein (casein), which is a constituent of a number of their products. Jacob and Co. Ltd. of Dublin, Ireland, also make or distribute Plasmon products.

Cestus bread has about the average composition of ordinary wheat bread.

Protein Preparations. These are casein and gluten products. The sample of *Aleuronat* contained about 71 per cent. of protein which is much less than the product now manufactured contains according to the statement of the American agents, Messrs. Glogau and Company, Chicago. They explain that the product now has a protein content of 96 per cent.

Plasmon contained 11.90 per cent. of nitrogen which is equivalent to about 76 per cent. protein (casein). Previous analyses of this product summarized in Bulletin 220 of this Station, show about the same nitrogen content. By an oversight in compilation, however, the protein was there calculated by the factor 5.7. If the factor 6.38 had been used these analyses would have been in substantial agreement with the recent analysis as given in Table VI.

The specifications for dietetic casein accepted by the American Medical Association[1] require that it contain 15 per cent. of nitrogen on the moisture-free basis. On that basis *Cheltine Milk Protein*, **20074,** contains 14.5 per cent. of nitrogen and the sample of *Plasmon*, **20066,** contains 13.5 per cent.

Breakfast Foods. We have no information that *Kellogg's* bran or *Plasmon* oats are designed for diabetic diets. *Hoyt's Gluten Flakes* is relatively low in starch but contains about 15 per cent. of available carbohydrate.

Alimentary Pastes. These preparations are macaroni and vermicelli made with casein instead of flour or gluten flour.

Cocoa. Cocoa generally will contain from 2.8 to 3.8 per cent. of nitrogen, from 8.5 to 13.5 per cent. of starch and from 30 to 40 per cent. of total carbohydrate (nitrogen-free extract). The term "diabetic" as applied to foods should signify a "considerable lessening of the carbohydrates" as compared with normal foods of the same class. Circular 136[2] prescribes that the glycogenic carbohydrates shall not be more than one-half as much as in the corresponding normal foods.

The sample of *Biogene Cocoa* examined contains more nitrogen than ordinary cocoa but neither the starch (about 10 per cent.), nor the total carbohydrate (about 31 per cent.), is substantially less than is found in cocoa of average composition. The same may be said of *Loeb's* diabetic cocoa. *Cheltine* milk cocoa shows 22

[1] New and Non-official Remedies, 1923.
[2] U. S. Dept. Agr., Office of the Secretary.

TABLE VI. ANALYSES OF

No.	Manufacturer and Brand
	Flours and Meals.
	Cereal Meal Corporation, St. Louis, Mo.
20137	Cereal Meal
	Cheltine Food Co., Cheltenham, England.
20056	Cheltine Diabetic Food
	Farwell and Rhines.
21222	Gluten Flour
	Federal Mill and Elevator Co., Lockport, N. Y.
20113	Gluten Flour
	Loeb's Diabetic Food Bakery, N. Y.
20828	Pure Gluten Flour
20829	Special Gluten
	Plasmon Ltd., London.
20067	Plasmon Arrowroot
	Pure Gluten Food Co., N. Y.
20666	Hoyt's Gluten Flour
	Miscellaneous.
20086	Cellulose Flour from Corncobs
21559	Wheat Flour
	Bakery Products.
	Callard & Co., London.
20083	Almond Biscuits No. 15
20043	Bran and Almond Biscuits No. 13
20039	Casoid Biscuits No. 17 A
20040	Casoid Rusks No. 8
20085	Gluten and Almond Biscuits No. 11
20081	Gluten Biscuits No. 9
20080	Gluten Cracknells No. 7
20079	Gluten Dinner Rolls No. 6
20038	Kalari Batons No. 5
20084	Parmesan Cheese Straws No. 17
20037	Ponos Biscuits No. 14
20082	Prolacto Biscuits No. 12
20078	Soup Sippets
	Cheltine Food Co., Cheltenham, Eng.
20073	Cheltine Assorted Biscuits
20075	Cheltine Brown Rusks
20076	Cheltine White Rusks
20062	Manhu Diabetic Biscuits
	Levine Bros., New Haven, Conn.
20114	Gluten Bread

Ash	Nitrogen	Protein		Fiber	Nitrogen-free Extract			Fat, Ether Extract	No.
		N x 6.25	N x 5.7		Starch	Sugar as Dextrose	Other N-free Extract		
%	%	%	%	%	%	%	%	%	
4.60	3.07	19.19	....	5.13	27.09	7.68	23.35	6.57	**20137**
6.89	9.26	57.88	....	0.78	8.64	7.76	3.34	10.05	**20056**
0.65	7.10	.....	40.47	0.34	38.90	4.34	5.12	1.37	**21222**
0.90	6.76	.....	38.53	0.41	39.60	2.70	6.88	1.78	**20113**
0.83	7.28	.....	41.50	0.15	36.68	3.04	7.39	2.19	**20828**
0.77	12.84	.....	73.19	0.19	8.66	0.76	8.70	1.97	**20829**
2.20	3.17	19.81	.....	0.11	61.59	0.65	2.53	0.13	**20067**
0.99	9.32	.....	53.12	0.42	29.14	2.24	3.43	3.26	**20666**
0.82	0.16	1.00	.....	63.80	0.34	none	28.50	0.54	**20086**
1.02	2.06	.....	11.74	0.76	58.50	8.10	6.37	2.49	**21559**
5.30	5.46	34.13	.....	1.66	0.39	3.10	2.79	48.55	**20083**
4.03	3.90	24.38	.....	4.14	0.49	2.32	3.81	57.49	**20043**
3.95	9.32	58.25	.....	0.13	0.32		1.71	24.60	**20039**
7.70	8.68	54.25	.....	0.09	0.49		4.91	26.58	**20040**
2.58	10.46	65.38	.....	0.29	2.15	0.93	0.00	23.25	**20085**
2.54	10.59	.....	60.36	0.40	2.42	0.98	3.90	23.90	**20081**
2.12	12.06	.....	68.74	0.24	3.18	0.18	4.68	14.68	**20080**
1.52	12.94	.....	73.76	0.18	4.56	0.60	5.40	7.09	**20079**
5.68	7.07	44.19	.....	0.38	trace	1.16	0.13	42.54	**20038**
5.79	5.00	31.25	....	0.50	3.48		6.61	48.94	**20084**
3.44	9.69	60.56	.....	0.33	1.25		2.64	19.23	**20037**
3.82	9.56	59.75	.....	0.22	0.26		4.74	20.45	**20082**
7.70	8.66	54.13	.....	0.03	0.52		6.99	28.74	**20078**
2.44	2.92	18.25	.....	0.55	46.18	5.28	5.28	16.00	**20073**
2.14	2.91	18.19	.....	0.22	45.42	5.55	10.75	9.71	**20075**
2.35	3.63	22.69	.....	0.20	40.44	7.53	4.61	14.79	**20076**
1.07	2.07	12.94	.....	0.80	52.59	9.12	5.55	11.96	**20062**
1.87	3.07	.....	17.52	0.29	23.83	1.89	11.68	3.75	**20114**

TABLE VI. ANALYSES OF

No.	Manufacturer and Brand
	Bakery Products—Concluded.
	Loeb's Diabetic Food Bakery, New York.
20139	Aerated Bread
20145	Genuine Gluten Bread
	Jacob & Co. Ltd., Dublin, Ireland.
20072	Plasmon Oat Biscuit
20071	Plasmon Plain Biscuit
20069	Plasmon Sweet Biscuit
20070	Plasmon Wholemeal Biscuit
	R. M. Scott, Ipswich, England.
20061	Gluten and Almond Biscuits
	Therapeutic Foods Company, Inc., New York.
20133	Dr. Charrasse Gluten Bread
20136	Dr. Charasse Gluto-Kola Bread
20135	Dr. Charasse Gluto-Soja Bread
20134	Dr. Charasse Supreme Bread
	Therapeutic Foods Company, London.
20055	Energen New Natural Gluten Bread
	Van Abbott & Sons, London.
20060	Soya Biscuits
	Miscellaneous.
20140	Cestus Bread, Gluten
21307	Gluten Bread
	Protein Preparations.
	Cheltine Food Co., Cheltenham, Eng.
20074	Cheltine Milk Protein
20698	Cheltine Milk Protein
	Glogau & Company, Chicago, Ill. (Sole Agents).
21558	Aleuronat
21874	Aleuronat
	Plasmon, Ltd., London.
20066	Plasmon Milk Proteid
	Breakfast Foods.
	Kellogg's Toasted Corn Flake Co., Battle Creek, Mich.
20193	Kellogg's Bran Cooked and Krumbled
	Plasmon, Ltd., London.
20059	Plasmon Oats
	The Pure Gluten Food Co., N. Y.

So-called Diabetic and Special Foods—(*Continued*).

sh	Nitrogen	Protein N x 6.25	Protein N x 5.7	Fiber	Nitrogen-free Extract: Starch	Sugar as Dextrose	Other N-free Extract	Fat, Ether Extract	No.
%	%	%	%	%	%	%	%	%	
.60	8.73	.....	49.76	0.34	20.76	2.83	7.00	12.18	**20139**
.83	5.71	.....	32.57	0.24	25.37	1.79	4.40	3.59	**20146**
.43	2.46	15.38	.....	0.26	37.91	11.34	6.09	20.73	**20072**
.54	2.98	18.63	.....	0.19	45.99	6.54	3.89	15.82	**20071**
.42	2.85	17.81	.....	0.18	43.88	9.70	4.64	15.18	**20069**
.85	3.20	20.00	.....	0.71	39.21	7.98	6.57	16.80	**20070**
.24	3.80	23.75	.....	0.50	40.73	3.76	3.18	19.91	**20061**
.25	7.49	.....	42.69	0.16	32.26	3.73	5.25	5.83	**20133**
.17	7.34	45.88	.....	0.16	32.76	4.50	0.00	6.02	**20136**
.20	7.77	48.56	.....	0.26	30.04	3.26	0.69	6.88	**20135**
.45	7.30	45.63	.....	0.22	32.60	3.33	0.64	6.92	**20134**
.97	5.80	.....	33.06	0.59	35.44	8.60	4.23	10.06	**20055**
.52	6.27	39.19	.....	2.20	2.50	8.94	11.82	24.98	**20060**
.15	1.97	.....	11.23	0.14	44.09	4.29	3.38	1.46	**20140**
...	3.18	.....	18.13	.....	40.71		.....	.....	**21307**
.08	13.24	84.47[1]	.....	none	none	0.19[2]	2.24	0.97	**20074**
...	13.38	85.36[1]	.....	.....	.....	.....	.....	.....	**20698**
.76	12.46	.....	71.02	0.26	7.14	3.54	3.59	5.58	**21558**
...	12.46	.....	71.02	.....	.....	.....	.....	.....	**21874**
.92	11.90	75.92[1]	.....	none	none	1.44[2]	1.87	0.72	**20066**
.30	2.31	14.41	.....	.....		68.53[3]		3.40	**20193**
.80	2.77	17.31	.....	0.53	54.45	2.94	5.86	8.09	**20059**
[illegible]	[illegible]		[illegible]	[illegible]	4.50	11.08	[illegible]	[illegible]	[illegible]

TABLE VI. ANALYSES OF

No.	Manufacturer and Brand
	Alimentary Pastes.
	Callard & Co., London.
20041	Casoid Flakes (Macaroni Paste)
20042	Casoid Vermicelli
	Cocoa.
	Callard & Co., London.
20044	Biogene Cocoa
	Cheltine Foods Co., Cheltenham, Eng.
20057	Cheltine Milk-Cocoa
	Loeb's Diabetic Food Bakery, N. Y.
20830	Diabetic Cocoa
20138	Diabetic Cocoa
	Plasmon, Ltd., London.
20065	Plasmon Cocoa
	Confections, etc.
	Callard & Co., London.
20049	Chocolate Biscuits
20045	"Casoid" Chocolates
20047	"Casoid" Dessert Chocolate
20048	"Casoid" Nut Chocolate
20050	"Ponos" Cocoanut Ice[1]
20046	Sugarless Chocolate
20077	Sugarless Jujubes (Peppermint)[2]
20052	Sugarless Glycerine Jujubes[2] (Pineapple)
20053	Sugarless Table Jelly[3]
	Lister Bros., New York.
20058	Lister's Sugar Free Candy[4]
	Plasmon, Ltd., London.
20068	Plasmon Chocolate
	Miscellaneous.
	Callard & Co., London.
20054	Cibrola

[1] Saccharin present, glycerine indicated.
[2] Glycerine present, gelatin indicated.
[3] Saccharin present, gelatin indicated.
[4] Gums, saccharin, glycerine and gelatin present.

So-called Diabetic and Special Foods—(*Concluded.*)

Ash	Nitrogen	Protein N x 6.25	Protein N x 5.7	Fiber	Nitrogen-free Extract: Starch	Sugar as Dextrose	Other N-free Extract	Fat, Ether Extract	No.
%	%	%	%	%	%	%	%	%	
7.41	12.56	78.50	.....	0.22	1.16		0.01	3.07	20041
7.31	12.80	80.00	.....	0.13	0.50		0.00	2.73	20042
7.50	5.29	33.06	.....	2.41	10.15	0.90	19.82	17.91	20044
5.14	7.53	47.06	.....	2.11	8.15	0.76	13.12	15.91	20057
5.47	5.29	33.06	.....	3.62	11.08	1.56	22.34	17.89	20830
5.80	4.07	25.44	.....	3.83	11.59	4.44	23.09	20.91	20138
7.74	8.07	50.44	.....	1.33	4.53	1.48	13.07	11.59	20065
4.11	4.18	26.13	.....	1.50	1.83	3.74	9.18	49.77	20049
3.14	3.67	22.94	.....	1.54	1.83	3.18	23.02	38.81	20045
3.95	3.98	24.88	.....	2.13	4.11	3.76	11.26	46.08	20047
3.88	3.82	23.88	.....	2.22	3.86	4.78	11.28	46.44	20048
1.29	1.38	.....	.....	1.19	3.12		....	36.18	20050
4.28	2.24	14.00	.....	3.16	5.85	8.14	17.33	44.34	20046
0.40	3.01	.....	.....	none	none	trace	.....	.....	20077
0.35	2.89	.....	.....	none	none	trace	.....	.....	20052
0.42	4.50	.....	.....	none	none	trace	.....	.....	20053
1.41	3.67	.....	....	none	none	trace	.....	.....	20058
1.74	2.20	13.75	.....	0.47	2.00	36.52	14.40	29.36	20068
10.86	11.94	76.18[5]	.....	none	none	0.19[6]	1.06	0.40	20054

tor 6.38.
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per cent. of total carbohydrate which is considerably less than the average and approximately one-half of the maximum found in the normal product. *Plasmon* cocoa shows material reduction in both starch and total carbohydrate, approximately one-half the normal amount in each case. This is largely due to the increase in nitrogenous material. In the tables protein has been calculated from the total nitrogen without allowance for the nitrogen in the theobromine and caffeine present.

Confections, etc. A number of samples of confections have been examined. These are generally prepared without sugar and may be sweetened with saccharin or glycerine. Gelatin was present in some cases. Glycerine is convertable to sugar by chemical methods and bacteria effect upon it a similar change.[1] According to various authorities it is also transformed to sugar in the body. Gums may be present, as in *Lister's* sugar-free candy. To what extent these substances yield sugar in metabolism we cannot state; but they result in the formation of a considerable amount of copper-reducing material by the usual chemical methods of hydrolysis and in all cases when gums were present or suspected they were excluded by precipitation with alcohol before total sugars were determined.

Plasmon chocolate contained about 36 per cent. of soluble carbohydrate and was evidently a sweet chocolate.

Cibrola is a preparation of casein probably reinforced with glycerophosphates.

Natural Foods of Interest to Diabetics.

The restricted diet to which the diabetic patient must conform presents a real problem. Rigid menus become monotonous and increased attention is being given to variety by those interested in diabetic dietetics. Dr. Allen has emphasized the importance of this factor and much has been accomplished in this direction particularly by one of his student-patients, Dr. Orton. Commenting upon these efforts Dr. Joslin says:

> "Diabetics everywhere throughout the world owe a debt of gratitude to Dr. W. A. Orton of the U. S. Department of Agriculture for his earnest endeavor to increase the number of agreeable vegetables. For this purpose he has brought to Washington specimens from all over the world. It is to be hoped that he will shortly publish a monograph giving the results of his work. Already there has appeared an article on the subject.[2] In England, also, the subject of gardening and vegetables for diabetics has been seriously considered by Spriggs.[3]"

This laboratory has collaborated with Dr. Orton by making analyses of a number of uncommon vegetables and other foods which have proved to be valuable adjuncts to the diabetic dietary.

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[1] Browne, Sugar Analysis, p. 771.
[2] Orton, W. A.: Am. Jour. Med. Sci. 1921, 162, 498.
[3] Spriggs, E. I.: Duff House Papers, Henry Frowde, London, 1920, 1.

Data on these and other foods submitted by physicians and others interested are given in Table VII.

Description of the character and uses of some of the uncommon foodstuffs which we have analyzed are of interest. It is taken chiefly from data furnished by Dr. Orton who submitted most of the specimens. The information concerning nuts was furnished by Mr. C. A. Reed of the Office of Horticultural and Pomological Investigations.

VEGETABLES.

Artichokes. The carbohydrate of the artichoke is largely or entirely inulin, a polysaccharide which is present also in dahlia and some other plants. A brief discussion of this carbohydrate has already been given in a previous bulletin.[1] The name Jerusalem artichoke is considered by authorities as highly inappropriate and "Girasole" and "Sunroot" have been suggested as more suitable names. The latter term is used in the latest edition of Robinson's "Vegetable Garden." The comparison between the analysis of the cooked and uncooked tubers is not a strict one because they were not made upon the same sample. Cooking was effected by steaming. Boiling in water would probably have shown greater differences in composition, particularly a greater loss in mineral matter in the boiled tuber.

String Beans, canned. The samples represent the standard commercial grades. The analysis of Fancy No. 1 grade is of the beans only, but those of the other grades are of the beans with accompanying liquor.

Chayote. The chayote (pronounced chi-ó-tay), belongs to the cucumber family and is a native of Mexico and Central America but is now cultivated as a garden vegetable in the Southern States and in California. There are a number of varieties varying in color, size and character of surface. The surface may be smooth, corrugated, spiny or spineless. The fruit may be eaten when immature but the quality improves with maturity. Cultural directions and recipes for preparing the vegetable for the table are given in a pamplet issued by the Bureau of Plant Industry at Washington.

Chinese vegetables. In submitting these samples Dr. Orton wrote as follows:

> "These are interesting Chinese specialties of which I believe no analysis has ever been made. Both are species of Brassica and are described by Prof. L. H. Bailey in his "Gentes Herbarum". The white-stalked vegetable, Bak Toy, is found on almost every oriental stand on the Pacific Coast cities. It makes an excellent salad and can be cooked in various ways. The green vegetable, Kai Tsoi, is perhaps, even more prized by the Chinese and we consider it an excellent mustard greens."

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[1] Conn. Exp. Sta., Bull. 236, p. 245, 1921.

TABLE VII. ANALYSES OF

No.	Material
	Vegetables.
20510	Artichokes, Jerusalem:
	fresh, whole tuber
20511	cooked, whole tuber
	cooked, edible portion
21560	Asparagus, fresh, edible portion
	Beans, canned:
20803	No. 1, Fancy green refugee, drained beans
20804	No. 2 Fancy green refugee beans and liquor
20805	No. 3 Fancy green refugee beans and liquor
20806	No. 4 Cut green Refugee beans
20807	Extra Standard No. 5 Cut green Refugee
20460	Chayote, green, fresh
20461	white, fresh
20462	white, fresh
20463	pale green Guatemalan, fresh
20464	dark green, fresh
20465	light green, fresh
	Chinese Vegetables:
21823	Kai Tsoi
21824	Bak Toy
	Palmetto cabbage:
20979	fresh
20980	cooked
	Peppers, dried:
20146	Neapolitan
20147	Squash, pungent
20149	Royal
20150	Sunnybrook
20151	Mexican, pungent
21561	Rhubarb, fresh, edible portion
	Salad Vegetables:
21565	Aralia Cordata (Udo)
21566	Celeriac
20030	Tomatoes, green, edible portion
	Vegetable Marrow:
20686	edible portion, fresh
20687	edible portion, cooked
	Nuts.
21562	Pignolia nuts, shelled
21563	Pistache nuts, shelled
21564	Cashew nuts, shelled
21569	Brazil nuts, shelled

NATURAL FOODS OF INTEREST TO DIABETICS.

Moisture	Ash	Nitrogen	Protein, (N x 6.25)	Fiber	Carbohydrate (other than fiber)			Fat, ether extract	No.
					Starch	Sugar, as dextrose	Other carbohydrate		
77.76	2.00	0.47	2.93	0.80	14.03[1]	0.20[2]	2.17	0.11	20510
75.85	1.60	0.44	2.77	1.09	15.43[1]	0.29[2]	2.87	0.10	20511
78.86	1.37	0.38	2.36	0.82	14.04[1]	0.23[2]	2.25	0.07	.....
92.15	0.69	0.48	3.00	0.70	0.08	0.70	2.37	0.31	21560
93.65	1.14	0.22	1.39	0.76	0.10	0.89	1.98	0.09	20803
94.43	1.07	0.16	0.98	0.53	0.06	1.21	1.62	0.10	20804
95.12	1.22	0.13	0.79	0.49	0.06	0.98	1.29	0.05	20805
94.08	0.97	0.16	0.99	0.55	0.12	1.45	1.78	0.06	20806
94.77	1.13	0.14	0.85	0.51	0.23	1.00	1.46	0.05	20807
90.38	0.54	0.19	1.16	0.93	2.98	2.25	1.66	0.10	20460
91.45	0.50	0.13	0.83	0.91	1.98	2.40	1.82	0.11	20461
92.45	0.37	0.11	0.70	0.87	1.26	2.55	1.69	0.11	20462
90.83	0.40	0.14	0.85	0.83	2.05	2.94	1.97	0.13	20463
94.13	0.37	0.13	0.83	0.51	0.57	2.28	1.22	0.09	20464
93.61	0.36	0.12	0.77	0.54	0.85	2.31	1.46	0.10	20465
94.56	1.08	0.27	1.71	0.70	0.03	0.42	1.31	0.19	21823
95.91	1.06	0.19	1.21	0.59	0.02	0.33	0.78	0.10	21824
87.22	1.74	0.53	3.33	0.93	1.01	1.00	4.13	0.64	20979
88.97	1.22	0.46	2.89	0.85	0.83	0.88	3.89	0.47	20980
9.60	5.55	1.86	11.63	7.57	1.55	35.15	25.35	3.60	20146
10.29	5.98	2.28	14.25	8.41	1.46	30.00	25.59	4.02	20147
9.64	5.55	1.94	12.13	7.59	1.24	35.35	25.47	3.03	20149
10.59	7.32	2.16	13.50	6.57	1.13	32.00	24.39	4.50	20150
8.15	5.42	1.63	10.19	5.93	1.32	36.10	23.34	9.55	20151
96.11	0.49	0.07	0.42	0.40	0.07	0.51	1.87	0.13	21561
95.29	0.51	0.16	0.97	0.50	0.07	1.07	1.44	0.15	21565
89.57	0.95	0.29	1.79	1.45	0.14	0.80	5.08	0.22	21566
94.72	0.62	0.19	1.21	0.42	0.36	1.19	1.25	0.23	20030
93.22	1.09	0.07	0.45	1.21	0.10	1.74	2.12	0.07	20686
93.03	1.04	0.07	0.41	1.36	0.08	1.89	2.13	0.06	20687
5.84	4.19	5.84	36.50	0.82	none	4.32	0.46	47.87	21562
5.80	2.79	3.88	24.25	1.75	none	6.13	8.20	51.08	21563
4.50	2.48	3.06	19.13	0.61	13.39	6.84	5.93	47.12	21564
3.41	3.35	2.69	16.81	2.10	none	1.30	3.65	69.38	21569

[1] Water-soluble carbohydrate after hydrolysis calculated from levulose to inulin, factor 0.9.
[2] Direct reducing sugar calculated as levulose.

Palmetto cabbage. This sample was submitted by Dr. Orton from Sanford, Fla. He explains that it is the bud of the palmetto, the common palm of Florida. The fibrous outer portions of the bud are discarded and the tender inner tissues constitute the edible portion which is esteemed as a food. Taking the bud, however, sacrifices the life of a tree.

Peppers, dried. These were grown at Arlington Farm, Virginia and sent by Dr. Orton. Only the edible portion was included in the samples. The original green weights of the samples are not recorded but the water content of the fresh material is propably 90 to 95 per cent. so that the percentages of the constituents given, other than moisture should be divided at least by 9 to approximate the composition of the fresh vegetable.

Salad vegetables. Samples of Aralia Cordata (or Udo) and of Celeriac were submitted by Dr. Orton in June, 1923. The Udo was freshly gathered and the Celeriac had been kept in storage since the fall of 1922. Both are desirable salad vegetables, one of the merits of the last named being that it keeps so well in storage.

Vegetable Marrow, Moore's Cream. This sample was submitted in February 1923 by Dr. Minot of Boston and had been stored since the previous fall. Analyses are of the edible portion i. e. with rind, seeds and placentae removed.

NUTS.

Brazil Nut.[1] (*Bertholletia excelsa*). Also called Cream Nut' Nigger Toe, Para Nut, Castanha, Butter Nut, etc. The fruit of a lofty uncultivated tree in the Amazon Country of South America. It is gathered by the natives and brought to the coast for export, Para being the principal center. These nuts are received in the United States from February to April and held in cold storage until late summer or early fall, when they are placed upon the market as the new crop.

Pignolia (*Pinus panes*).[2] The edible seeds of the stone pines of southern Europe are imported into this country in large quantities. They are rarely seen this side of the Atlantic except in the shelled condition. These nuts are chiefly imported from Tuscany, the Castilian section of Spain and sometimes, but rarely, from Turkey.

Pistache (*Pistacea vera L.*) This species is said by "Nut Culture in the U. S." to have originated in Syria; however, it is now well established in the warmer countries of Europe, Asia, and Africa. It was introduced into this country nearly a half century ago and is now receiving considerable attention in California and other parts of the West and Southwest.

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[1] Specimens contributed by Hills Bros. Co., New York.
[2] Specimens from lot purchased from Wood and Selick, Inc., New York.

Cashew (*Anacardium occidentale L.*) This species is widely known throughout the tributaries of the greater part of the world. It is peculiarly interesting in two respects: First, the seed, shaped like a large bean not unlike a kidney, both in form and color, forms on the apical end of a fleshy, pear-shaped, yellowish or crimson fruit. Its method of attachment is decidedly unnatural in appearance. Second, the seed is incased within two thin but firm shells, between which there is enclosed a brownish colored fluid, extremely poisonous to the skin. This is readily dispelled by roasting, but in the process strong fumes are given off which are said to be highly irritating to the eyes. Painful cases of poisoning have been experienced by those handling this nut in the unroasted condition. This might be anticipated since the species is closely allied to our poisonous sumac and ivy in this country.

From the standpoint of composition these nuts are characterized by high contents of oil and relatively high protein. The carbohydrate is correspondingly low, particularly the part which may be regarded as available. Cashew nuts are conspicuous in the group in that they contain over 13 per cent. of starch.

EGGS.

Frequent requests are received from the Dairy and Food Commissioner to determine whether eggs sold under the designation of "fresh" are in fact fresh eggs. The examination made in such cases has been based chiefly upon the characteristics of the eggs as shown before the candle and on breaking out of the shell as noted in a previous report.[1] Lythgoe[2] and others, cite the determination of ammonia as useful additional evidence in deciding the question of freshness. The actual figures obtained for ammonia content, however, are always to be interpreted in connection with evidence obtained as to physical characteristics and also with inspection evidence.

We have made a limited number of trials in which eggs of known freshness[3] were held for a period of 40 days, the ammonia content being determined at intervals during that time. The eggs were held in a reasonably dry atmosphere protected from light, and the temperature varied from 36° to 73° F, the average mean temperature being 56° F. These conditions probably represent those under which eggs are often held in practice. There were 24 eggs in the lot and they were examined in eight groups of three eggs each. The results are not regarded as final criteria for classification but they are useful for reference and furnish some interesting comparisons. In general the air spaces were less than 1 inch in diameter (5/8 to 7/8), until the eggs were 21 days old. Until about this time also the yokes were not appreciably settled and the whites remained fairly firm. After 21 days the air spaces were one inch or more in diameter, the yolks were uniformly settled to one side of the shell and the whites were thin or watery.

Ammoniacal nitrogen determined at four intervals between 1 day and 15 days ranged from 1.3 to 2.1 milligrams and averaged 1.9 milligrams per 100 grams of egg. The average for the interval twenty-two to thirty-two days was 2.3 milligrams and from thirty-three to forty days it was 2.9 milligrams per 100 grams. Ammoniacal nitrogen was not found uniformly progressive in the later intervals but, in general, the results showed that up to two weeks the average content was slightly under 2 milligrams; from then up to one month the average was less than 2.5 milligrams and thereafter and up to about six weeks the average was 2.9 milligrams. At about three weeks the eggs, under the conditions of this experiment, began to show the characteristics of staleness, as judged by candling, at which time the ammoniacal nitrogen was found to be somewhat in excess of 2 mgs. per 100 grams of egg. At the end of the experiment the eggs were very stale but not rotten and the ammoniacal nitrogen found was about 3 mgms. per 100 grams.

Remington[4] has cited the probable limits of ammoniacal nitrogen in fresh eggs as from 1 to 1.5 mgms. per 100 grams. At about 2 mgms. the characteristics of staleness are noted and eggs containing 2.5 mgm. or more are very stale. Lythgoe[5] regards a strictly fresh egg as not exceeding 1 mgm. of ammonia while one containing 2 mgms. might be regarded as reasonably fresh. Lythgoe further suggests that large air spaces with low ammonia indicate eggs held at low (cold storage) temperature, while large air spaces with high ammonia indicate eggs held at higher temperatures.

A sample consisting of twelve eggs purchased in the market as *fresh* showed air spaces generally less than three-fourths of an inch in diameter, yolks and whites were normal and the ammonia content varied from 0.9 to 1.3 mgms., averaging 1.0 mgm. per 100 grams. The eggs clearly qualified as fresh.

Six other samples of six eggs each were purchased at prices ranging from thirty to forty-five cents per dozen, the quality of freshness being emphasized or implied in most cases. One of these samples might be passed as reasonably fresh, but the others, though edible, could not be called fresh eggs.

Determination of Ammoniacal Nitrogen in Eggs.

For the determination of ammoniacal nitrogen an adaptation of the Folin method was employed.

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[1] Conn. Exp. Sta. Bull. 248, p 394.

[2] Mass. State Board of Health, Report of 1911, p 431.

[3] The eggs were laid March 1st, 1923 and were less than 24 hours old when the experiment began.

[4] U. S. Dept. Agr., Bull. 51, July 1914.

[5] Loc. cit.

REAGENTS.

Nessler solution: Prepare as described in A. O. A. C. Methods of Analysis, p. 22.

Sodium carbonate: Saturated solution.

Potassium oxalate: Saturated solution.

White Mineral Oil.

Hydrochloric acid, N/10: Make approximately N/10 by diluting concentrated hydrochloric acid with ammonia-free water.

Ammonia-free water: Redistil distilled water from alkaline potassium permanganate and reject the first portion of the distillate. Acidify the remainder of the distillate with dilute sulphuric acid and distil again.

Standard ammonium sulphate: Aerate a concentrated solution of ammonium chloride, which has been made alkaline with sodium hydroxide, into dilute sulphuric acid until the acid is neutralized, using the regular Folin aeration apparatus. Precipitate the ammonium sulphate by means of alcohol, filter and wash with alcohol. Dissolve and reprecipitate the salt, filter and dry in a vacumm desiccator. Take 0.4717 gm. of the dry ammonium sulphate and make up to 500 cc. Five cc of this solution is equivalent to 1 mgm. of nitrogen.

DETERMINATION.

Break three eggs into a suitable dish and mix by beating thoroughly. Weigh 20 gms. into the cylinder of the Folin apparatus, add 5 cc of sodium carbonate, 2 cc of potassium oxalate and 5 cc of mineral oil. Place 2 cc of N/10 hydrochloric acid and 50 cc of ammonia-free water in a 100 cc graduated flask used as a receiving flask. Connect the apparatus with the blast pump and aerate the sample for two hours. Nesslerize the contents of the receiving flask as follows: Take 5 cc of Nessler solution, dilute with 25 cc of ammonia-free water, add it to the contents of the receiving flask in three portions, mixing after each addition, then make up to volume of 100 cc and thoroughly mix. Take 5 cc of standard ammonium sulphate solution, dilute with ammonia-free water, add 5 cc of Nessler solution diluted with 25 cc of ammonia-free water and make up to volume of 100 cc. Estimate the amount of nitrogen in the unknown solution by comparison with this standard solution (which contains 1 mgm. of nitrogen), using a Duboscq colorimeter.

Determine the efficiency of the apparatus from time to time by aerating known quantities of the standard solution. Introduce also the necessary correction for blanks run with the reagents alone at the time of each trial or series of trials.

FATS AND OILS.

Butter.

Five samples of butter were examined for the Dairy and Food Commissioner and all were passed as genuine.

Cocoanut Fat.

A sample of a fat was submitted by Prof. Fisher of Storrs for identification. Constants were determined as follows:

Polensky No. 11.7, Reichert-Meissel No. 7.2, Kirschner No. 2.3, Butyro-refractometer reading at 40° C, 36.

The constants indicated cocoanut fat which the sample proved to be.

Cooking Fats.

A sample of Nut-z-all, D. C. No. **24809** was examined as follows:

Moisture 10.73 per cent., fat 87.58 per cent., salt 1.37 per cent., casein (by difference), 0.26 per cent., undetermined mineral matter 0.06 per cent. Butyro-refractometer reading at 40°C. 36.5°. Reichert-Meissel No. 8.95. Halphen test negative.

The sample has substantially the same composition as that of other vegetable fat margarines which we have examined.[1]

Olive Oil, etc.

Seven samples were examined six of which were submitted by the Dairy and Food Commissioner. Five were sold for olive oil and no adulterants were found. Two samples contained cottonseed oil. They were not, however, sold as olive oils but as table oils.

Phosphoric Acid Content of Some Cooking Fats.

A number of cooking fats were examined for phosphoric acid in connection with the determination of alcohol-ether-soluble phosphorous in baked products. Lard, Snowdrift, Crisco, Mazola, Oleomargarine, vegetable oil margarine and butter were included. The clear fats were ashed and treated as described in the methods of Jacobs and Rask[2]. In no case did the fats show more than traces of phosphoric acid (P_2O_5), by the method employed. In the case of butter and the margarines, when the whole products were used, appreciable quantities of total phosphoric acid were found due to the non-fat milk constituents present. Thus butter contained 0.038 per cent., oleomargarine 0.024 per cent., and vegetable oil margarine 0.019 per cent. of total phosphoric acid (P_2O_5).

[1] Conn. Exp. Sta., Bull. 210, p 203. 1918.
[2] Jour. Assoc. Official Agr. Chemists, **6**, 11. 1922.

FLOUR.

In connection with the analysis of egg-flour mixtures as described under alimentary pastes,[1] fifteen samples of commercial flour, analysis of which were published last year,[2] were further examined for lipoid phosphoric acid by the alkaline extraction method of Jacobs and Rask as used in the examinations of our egg-flour mixtures and of commercial noodles. In addition to these flours three authentic samples[3] of recognized grades of flour were also analyzed. A summary of the results obtained on the market flours and the analyses of the three authentic samples are given in Table VIII.

TABLE VIII. ANALYSES OF COMMERCIAL FLOUR AND OF THREE AUTHENTIC SAMPLES OF FLOUR.

Description.	Moisture, (5 hrs. at 105°C)	Ash	Protein, (N. x 5.7)	Fat, (Alc-ether extract)	Acidity, (as lactic acid)	Lipoid-P_2O_5, (moisture-free basis)
Commercial flours	%	%	%	%	%	%
Maximum........	13.63	0.48	11.97	1.67	0.13	0.060
Minimum........	11.18	0.36	7.03	1.03	0.06	0.035
Average........	12.21	0.43	9.79	1.38	0.10	0.046
Authentic samples						
First patent.......	9.70	0.38	11.40	1.21	....	0.043 +
Straight..........	10.08	0.48	11.74	1.50	....	0.045 –
First Clear........	9.77	0.64	13.11	1.66	....	0.045 +

The figures obtained for the alcohol-ether soluble phosphoric acid content of flour are, on the average, somewhat lower than have been reported by some other workers. In the method employed,[4] after evaporating the combined extracts to dryness there was found to be a considerable amount of material which was insoluble in the ether-petroleum ether mixture and this was removed by filtration. Filtration at this point is a departure from the method as described but it seemed evidently improper to include material insoluble in the reagents indicated. This may be a partial explanation of the discrepancy noted.

GELATIN

A sample of gelatin, **21225**, made by the Grayslake Gelatine Co., Grayslake, Ill., was examined as follows:

Moisture, determined 12.92 per cent.; by difference 12.47 per cent.; ash 0.26 per cent.; nitrogen 15.72 per cent., equivalent to gelatin 87.24 per cent.,

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[1] See page 167.
[2] Conn. Exp. Sta. Bull. 248, p. 401.
[3] These were obtained through the courtesy of Mr. C. B. Morison, American Institute of Baking.
[4] Jour. Assoc. Official Agr. Chemists, **6**, 11. 1922.

(factor 5.55); fat 0.03 per cet.; keratin none found; arsenic none found; copper slight trace; zinc trace(?); in hot water solution, clear and no odor.

The analysis indicates a very pure product.

HONEY.

One sample of comb honey, **21603**, was submitted by a producer. Partial analysis was made as follows:

Ash 0.41 per cent.; moisture (in vacuum over sulphuric acid, room temp.) 10.67 per cent.; polarization—2.4° at 20° C.

The results obtained are substantially within the limits as given for honey by Leach.[1]

ICE CREAM.

Three hundred and thirty-nine samples of ice cream have been examined for the Dairy and Food Commissioner and two samples have been submitted from other sources. A summary of the results by towns or cities is given in Table X.

Only five samples were found to be substantially deficient in milk fat. One sample purchased from Rosario Cipolla, Hartford, was found to contain but 3 per cent. of fat. Two samples taken subsequently contained approximately the same amount but the dealer was protected by the display of a sign declaring the composition of his product.

The samples presumed to be of standard quality, but found to be deficient are as follows (Table IX):

TABLE IX. ICE CREAM BELOW STANDARD.

No.	Dealer	Manufacturer	Flavor	Fat
	Hartford			%
24937	Rosario Cipolla...........	Own make......	Vanilla.....	**3.0**
	New Britain			
25647	Charlie Piccolei...........	Own make......	Vanilla.....	**5.1**
	New Haven			
27236	Francisco De Felice.......	Own make......	Vanilla.....	5.4
	Stamford			
26758	A. Esposito..............	Own make......	Vanilla.....	7.1
	Unionville			
26018	Charles A. Hackney.......	Own make......	Vanilla.....	6.7

TABLE X. INSPECTION OF ICE CREAM.

City or Town	No. of Samples	Fat Content, Range		Average
		%	%	%
Ansonia	10	11.2	8.0	10.0
Bridgeport	33	21.0	7.8	12.0
Bristol	3	15.6	11.2	13.7
Collinsville	2	15.4	15.4	15.4
Crescent Beach	1	....	....	16.0
Danbury	11	17.2	9.2	11.7
Danielson	1	....	....	9.6
Derby	1	....	....	9.2
Forestville	3	15.0	11.4	12.8
Greenwich	5	15.4	11.2	13.5
Hartford	34	18.4	2.8[1]	13.5
Jewett City	2	18.0	14.0	16.0
Litchfield	1	....	...	13.8
Meriden	8	14.4	9.4	11.5
Middletown	9	17.6	12.8	14.8
Montville	1	....	....	8.0
Moosup	2	22.0	20.0	21.0
Mystic	3	24.0	12.0	18.3
Naugatuck	5	13.2	9.2	10.8
New Britain	12	14.0	5.1	11.1
New Haven	46	20.4	5.4	11.8
New Milford	5	18.4	7.8	11.6
New London	16	20.0	10.0	14.9
Norwalk	3	13.8	8.6	11.0
Norwich	12	24.0	10.0	15.4
Pawcatuck	4	19.6	10.8	15.2
Plainfield	1	....	....	13.0
Plainville	2	16.4	11.4	13.9
Pomfret	2	24.0	20.0	22.0
Portland	1	....	....	14.8
Putnam	7	22.0	12.4	16.1
Rockville	2	16.4	16.0	16.2
Somers	1	....	....	16.0
Somerville	1	....	....	11.6
Southington	1	....	....	14.8
South Manchester	4	16.0	11.2	13.3
South Norwalk	3	15.6	11.2	12.7
Stafford Springs	6	17.4	12.0	14.9
Stamford	12	17.4	7.1	11.5
Stonington	1	....	....	14.0
Stratford	1	....	....	11.4
Suffield	3	11.4	8.6	9.9
Terryville	1	....	....	10.0
Thomaston	3	14.8	11.2	12.6
Thompsonville	7	14.4	8.4	12.8
Torrington	7	14.4	7.4	11.0
Unionville	2	6.7	6.2	6.4
Wallingford	8	16.0	11.6	14.1
Waterbury	13	15.0	8.4	11.4
Waterford	1	....	....	10.4
West Wauregan	2	11.2	8.0	9.6
Willimantic	9	16.0	8.8	14.3
Winsted	5	18.4	9.8	13.4
Total	339			

The manufacturers of ice cream may be divided, broadly, into two groups, *viz.*, those who exercise careful factory control and aim to keep their output reasonably close to the legal standard for fat; and those who intentionally make high-fat products for a special trade or who unintentionally, through lack of control, put more milk fat into their product than the law requires. In general, the large producers belong to the first-named group, and without data as to the comparative production of the two groups a study of the results for fat obtained on official samples will not give an adequate idea of the average fat content of ice cream sold in the State. However, with proper reservations it is of interest to consider, on the basis of fat content, the classification of official samples of ice cream examined in the five years since the ice cream law became effective.

CLASSIFICATION OF OFFICIAL SAMPLES OF ICE CREAM ON BASIS OF FAT CONTENT, 1919-1923 INCL.

	No. of Samples	Per cent.
8.0–9.9 per cent. fat	387	26.1
9.9–11.9 per cent. fat	344	23.2
12.00 per cent. and above	609	41.1
Below 8 per cent	142[1]	9.6
Total	1482	100.0

DETERMINATION OF FAT IN ICE CREAM.

The necessity for a rapid test for fat in ice cream has been felt by all analysts who are required to test ice cream in a routine way for purposes of control. For this purpose various modifications of the Babcock test have been suggested from time to time, but none have proved to be uniformly satisfactory or reliable. We have used the method as described by Lichtenberg[2] which, according to Troy[3], is substantially like a procedure previously described by Ross. A method suggested by Utt[4] employs the same reagents but after the addition of acetic-sulphuric acids the mixture is heated before centrifuging. A procedure[5] which is a combination of the two just mentioned, but which gives better satisfaction than the Lichtenberg method which we have heretofore used, is carried out as follows:

Transfer 9 grams of the well mixed sample to a 10 per cent. milk-test bottle. Add 10 cc. of glacial acetic acid, mix thoroughly, and place in a water bath at a temperature of 75°–80° C for thirty minutes, shaking the bottle several times during the heating. Remove from the bath, add 5 cc. of water and 10 cc. of sulphuric acid of the strength used in the Babcock test. Mix thoroughly and

[1] Includes 32 fruit ice creams of legal standard, viz., 6 per cent.
[2] J. Ind. Eng. Chem., **5**, 786. 1913.
[3] Ibid., **5**, 960. 1913.
[4] Ibid., **7**, 773. 1915.
[5] Suggested by R. E. Andrew.

whirl in a centrifuge for 10 minutes. Add hot water up to the neck of the bottle and whirl for five minutes after which bring the fat column up into the graduation and whirl for three minutes longer. Multiply the fat reading by two for the percentage of fat in the sample.

The Roese-Gottlieb method is used in all cases where an amount of fat less than that required by the standard is found.

MILK AND MILK PRODUCTS.

Market Milk.

Twelve hundred and twenty-eight samples of milk have been examined for the Dairy and Food Commissioner and on the results of analyses are classified as follows:

Not found adulterated	706	57.5%
Adulterated by dilution with water	113	9.2
Adulterated by skimming	73	5.9
Adulterated by skimming and diluting with water	3	0.2
Adulterated by reason of being		
below standard in solids and solids not fat	136	11.1
below standard in solids and fat	29	2.4
below standard in solids, fat and solids-not-fat	168	13.7
Total	1228	100.0

Samples found to be adulterated by dilution with water, by skimming or by skimming and dilution are given in Table XI.

One hundred and thirty-one samples submitted by consumers or producers require no particular comment.

Tester's License.

Three samples of milk and nine samples of cream were tested for fat to check results obtained by candidates for license to test milk and cream as required by Sec. 1 of Chapter 180, Public Acts of 1923 amending Sec. 2464 of the General Statutes.

Evaporated Milk.

Twenty-three samples of evaporated milk and one of evaporated skimmed milk were collected by the Station agent. One sample was submitted by the Dairy and Food Commissioner and three were received from other sources.

The standard for *condensed milk, evaporated milk, concentrated milk,* requires, all tolerances allowed for, not less than 7.8 per cent. of milk fat and not less than 25.5 per cent. of total milk solids; provided, however, that the sum of the percentage of fat and of total solids be not less than 33.7[1].

Analyses of these samples are given in Table XII.

[1] F. I. D. 189.

TABLE XI. ADULTERATED MILK.

No.	Dealer	Solids	Fat
	Containing Added Water		
	Ansonia.	%	%
25856	Sam Ferlo	10.97	3.5
25857	Sam Ferlo	10.71	3.2
	Branford.		
26972	William Hall	11.01	3.4
25837	G. G. Nesbit	10.93	3.4
	Brewster, N. Y.		
25777	Weizenecker Bros	10.17	3.2
25778	Weizenecker Bros	10.34	3.2
25779	Weizenecker Bros	10.10	3.1
25780	Weizenecker Bros	10.05	2.9
25781	Weizenecker Bros	9.61	2.9
25782	Weizenecker Bros	10.2	2.7
25783	Weizenecker Bros	9.52	2.7
25784	Weizenecker Bros	10.03	2.9
	Bridgeport.		
24857	R. F. Barske	10.96	3.3
24858	R. F. Barske	11.33	3.6
24859	R. F. Barske	10.98	3.4
24794	Connecticut Lunch	10.53	2.9
24662	John Pappas	10.62	3.2
25916	Snow & Snow	10.52	3.2
24797	The Brothers Lunch	10.53	3.0
	Bridgewater.		
25787	Lee S. Dickenson	9.32	2.7
25788	Lee S. Dickenson	10.39	3.2
25789	Lee S. Dickenson	10.55	3.1
25790	Lee S. Dickenson	9.42	2.6
	Colchester.		
25711	A. Macker	10.47	3.1
25712	S. Schmil	8.87	2.6
25713	S. Schmil	7.90	2.0
	Cornwall Bridge.		
24616	H. Chapman	10.47	3.1
24617	H. Chapman	10.46	3.3
24618	H. Chapman	9.10	3.0
24619	H. Chapman	11.09	3.4
24620	H. Chapman	9.29	2.3
22247	W. Livenstone	10.92	3.2
22232	F. Lorch	11.42	3.7
22238	J. Lorch	10.25	3.0
24611	Mrs. P. Tamgo	10.72	3.1

No.	Dealer	Solids
	Containing Added Water—*Continued.*	
	Danbury.	%
25775	Morey Bros. Store	10.3
25771	Pure Milk & Cream Co.	10.2
25776	United States Stores Company	10.5
	Durham Center.	
25235	W. I. Parmelee	9.3
25236	W. I. Parmelee	8.5
25237	W. I. Parmelee	9.2
25238	W. I. Parmelee	9.4
25239	W. I. Parmelee	9.1
25240	W. I. Parmelee	11.3
25241	W. I. Parmelee	9.7
	East Haddam.	
25710	Max Ludnar	10.3
	East Hampton.	
25709	J. M. Peters	9.6
	East Haven.	
26955	Thomas Shirsky & Son	9.8
	Goshen.	
25993	H. E. Cass	11.9
	Leonard's Bridge.	
26305	Root Bros	10.9
	Meriden.	
26365	C. H. Childs	11.1
27700	C. H. Childs	11.5
27703	C. H. Childs	11.4
26370	Wm. Hozlett	7.3
24523	E. J. Kaemner	11.6
26368	Wm. Pomeroy	10.6
24516	Presto Lunch	11.2
24526	Presto Lunch	11.4
24517	Quality Lunch	11.2
24527	Quality Lunch	11.4
24518	Smart's Lunch	10.8
24528	Smart's Lunch	11.0
	Monroe.	
26985	Sam. Goldstein	11.1
26983	Anton Shura	11.1
26984	Anton Shura	10.7

TABLE XI. ADULTERATED MILK—(*Continued*).

No.	Dealer	Solids	Fat
	Containing Added Water—*Continued.*		
	New Britain.	%	%
4874	James Portigo..........	11.24	3.5
4876	James Portigo..........	10.91	4.3
4877	James Portigo..........	9.74	3.2
5026	Tony Tomaszeski.......	10.23	2.9
	New Hartford.		
6520	Louis Malaten.........	10.40	3.1
6522	Louis Malaten.........	10.30	3.0
	New Haven.		
4729	T. F. Fitzsimmons......	12.64	5.5
	New Preston.		
7469	John Chemski.........	10.62	3.2
7470	John Chemski.........	10.07	2.6
7472	John Chemski.........	10.31	2.9
	Newtown.		
6990	Chas. R. Beardsley.....	10.71	3.3
6991	Chas. R. Beardsley.....	10.80	3.5
	Northford.		
6389	D. Formissano.........	10.90	3.5
	North West Chester.		
5708	John Lensewsky........	10.03	3.4
	Orange.		
7681	C. Winkle.............	10.25	3.6
7748	C. Winkle.............	10.62	4.2
7749	C. Winkle.............	12.05	4.7
7683	Philip Yarash..........	10.24	3.2
7750	Philip Yarash..........	10.04	3.3
7751	Philip Yarash..........	11.27	4.1
	Rockville.		
7319	Louis Pestretto.........	9.49	2.8
7320	Louis Pestretto.........	8.96	2.4
7321	Louis Pestretto.........	10.26	3.4
7322	Louis Pestretto.........	10.18	3.4
	Roxbury.		
5792	N. Oguan.............	9.65	2.6

No.	Dealer	Solids
	Containing Added Water—*Concluded.*	
	Shelton.	%
26361	Joe Ovesny............	10.43
	So. Manchester.	
24543	Frank Beccio..........	10.43
24544	Frank Beccio..........	10.55
	Stamford.	
24805	Bliss Lunch............	10.76
	Stepney.	
14518	I. Sippin...............	9.47
	Trumbull.	
24162	Jessie G. Lyon.........	9.60
24163	Jessie G. Lyon.........	10.80
24164	Jessie G. Lyon.........	9.17
	Wallingford.	
25582	Geo. Nesbit...........	10.95
25898	Mrs. A. E. Quigley......	7.03
25899	Mrs. A. E. Quigley.....	9.71
26350	Mrs. A. E. Quigley.....	9.52
	Westport.	
25942	Silverbrook Farm.......	11.16
25945	Silverbrook Farm.......	10.50
25946	Silverbrook Farm.......	8.48
25947	Silverbrook Farm.......	8.32
	West Cheshire.	
27708	Howard E. Ives........	10.06
	West Chester.	
25707	Solomon Sugannan......	11.46
	West Hartford.	
24950	C. A. Carlson..........	10.17
	Yalesville.	
27752	Chas. Carttanota.......	9.75
27753	Chas. Carttanota.......	9.27
	Yantic.	
25724	Gregory Muckensturm..	9.04
25714	Wm. Tibbitts..........	8.59
25715	Wm. Tibbitts..........	8.34
25716	Wm. Tibbitts..........	8.52

TABLE XI. ADULTERATED MILK—(*Continued*).

No.	Dealer	Solids	Fat
	Skimmed Milk		
	Amston.	%	%
6404	Morris Freeman........	11.19	2.7
	Bridgeport.		
2984	Columbia Lunch.......	10.52	2.2
2988	Garden Restaurant.....	10.66	2.3
2986	Harvard Lunch........	10.91	2.4
2979	477 Main Street........	10.79	2.3
4650	Pappas Bros...........	9.50	1.1
2990	Phoenix Lunch.........	11.09	2.7
	Danbury.		
3421	Joe Hurst.............	9.77	1.5
	Danielson.		
5180	Wm. S. Brown.........	9.50	1.1
	Hartford.		
4764	Armory Lunch.........	10.70	1.9
4761	Asia Restaurant........	10.00	1.1
4313	Baldwin's Lunch.......	11.42	2.3
4314	Central Lunch.........	10.04	0.8
6543	Colt's Lunch..........	11.93	2.2
4319	Cranton's Coffee Lunch.	11.56	2.5
7207	Crystal Lunch.........	11.08	2.2
4317	Eagle Lunch..........	10.34	1.7
4340	Gem Lunch............	9.99	1.3
4754	Grand Restaurant......	11.24	2.7
7311	Hillside Lunch.........	10.91	1.9
4758	Jack's Lunch..........	12.45	3.2
7609	Kosher Restaurant.....	9.83	1.0
4320	Longley's Lunch.......	10.71	2.0
4798	McNamara Lunch......	10.30	2.1
6549	New Way Lunch.......	10.94	2.3
4326	Victory Lunch.........	9.58	1.0
7204	Victory Lunch.........	10.30	1.6
4343	Virginia Lunch.........	9.90	1.1
6529	Waldorf Lunch.........	11.44	2.7
6539	Waldorf Lunch.........	10.72	1.7
7601	Waldorf Lunch.........	10.32	1.2
4753	Washington Lunch.....	9.72	1.2
7611	Washington Lunch.....	10.43	1.5
6546	Welcome Lunch........	11.27	2.4
	Leonard's Bridge		
5892	Root Bros.............	10.29	1.8
	Moosup.		
5191	A. T. Hill.............	11.58	2.7
	Skimmed Milk— *Continued.*		
	New Britain.	%	
24771	Hudson Lunch.........	11.22	2
	New Haven.		
24841	B. & L. Lunch.........	11.08	2
24715	Barberito Lunch.......	10.98	1
25123	Chicago Lunch.........	10.86	2
24828	Citizen's Lunch........	10.14	1
24816	Diamond Lunch........	9.79	1
25118	Grand Restaurant......	9.46	0
24840	Loft's Inc.............	11.00	2
25109	New Haven Oyster and Chop House........	10.79	2
24833	Old Homestead Lunch..	10.63	1
25111	James Otis Restaurant..	10.48	2
25102	Oxford Lunch..........	9.54	1
24813	P. & G. Restaurant.....	10.46	1
24713	Quality Del. & Lunch...	11.17	2
24817	Mrs. Root's Food Shop..	10.24	1
24700	Smith Lunch...........	11.30	2
24707	Waterbury's Luncheon-ette................	11.38	2
	Newington.		
27251	M. Gacovitz...........	10.60	2
	Northford.		
25244	Fred Wellman.........	11.62	2
	Plainville.		
22977	Collins Restaurant......	10.21	1
	South Norwalk.		
22993	Savoia Restaurant......	11.37	2
	Stamford.		
24677	Carter's Lunch Room...	9.64	1
24800	Hartford Lunch........	10.25	2
24670	Joe Kerbel............	9.27	1
24671	S. J. Ross.............	10.17	2
	Torrington.		
26162	Mrs. H. Hennessey.....	10.82	2
	Wallingford.		
27593	Louis Naisnerska.......	11.25	2
27594	Louis Naisnerska.......	11.00	2
27595	Louis Naisnerska.......	11.19	2

TABLE XI. ADULTERATED MILK—(*Concluded*).

No.	Dealer	Solids	Fat	No.	Dealer	Solids	Fat
	Skimmed Milk— *Continued.*				**Skimmed Milk—** *Concluded.*		
	Waterbury.	%	%		*Woodbridge.*	%	
954	A. Blazevich	12.06	3.0	24190	Pattsy Lonzo	9.80	2
960	Boston Lunch	11.41	2.5				
966	Hodson-Dean Lunch	11.01	2.4				
962	Plaza Lunch	10.96	2.3		**Skimmed and Watered**		
965	Star Lunch	10.60	2.1				
	Willimantic.				*Bridgeport.*		
368	Joe Putnyk	11.10	2.3	24665	Efford & Murray	9.48	2
367	R. Verry	10.84	2.3	24792	Home Restaurant	10.10	2
				22987	New York Lunch	9.17	2

It will be noted that the requirements of the standard are such that the sum of the percentages of solids and fat shall not be less than 33.7, that is to say, if an evaporated milk contains only the minimum of fat, viz., 7.8 per cent., then it cannot have also the minimum of 25.5 per cent. of solids, but must have at least 25.9 per cent. to make the required sum of 33.7; on the other hand a brand having the minimum of total solids (25.5 per cent.), must have at least 8.2 per cent. of fat.

The analyses show that the samples examined equalled or exceeded the standard in practically all cases. One sample of *Dairylea*, **21615**, was deficient, but two others fully met the requirements. *Sealect* brand, **20412**, was also deficient; a second sample could not be secured.

SWEETENED CONDENSED MILK.

One sample was submitted by Prof. Fisher of the Storrs Station to be examined for sucrose. It was found to contain 42.64 per cent. of that sugar.

CHOCOLATE-MILK MIXTURES.

Two samples of milk or skimmed milk mixed with cocoa or chocolate have been submitted for analysis. These were sold under the distinctive names of *"400"* and *"Angel Drink"* and were bottled by dairies. In substance they are analogous to the so-called chocolate-milk drinks long sold at soda fountains. In some States regulations have been passed fixing a minimum of milk fat which such products shall contain but no special regulations have been issued in this State.

Analyses of the products examined are as follows (p. 199).

TABLE XII. ANALYSES OF EVAPORATED MILK.

Sta. No.	Brand and Manufacturer or Dealer	Water	Solids	Ash	Protein (N×6.38)	Fat	Solids + Fat
	Evaporated Milk	%	%	%	%	%	%
20409	*A. & P.*, The Great A. & P. Co.	73.21	26.79	1.60	6.64	8.03	34.8
21672	*Armour's Veribest*, Armour & Co., Chicago, Ill.,	73.93	26.07	1.57	6.76	7.95	34.0
21629	*Borden's.* The Borden Co., N. Y.	73.98	26.02	1.57	7.98	8.18	34.2
21621	*Carnation.* Carnation Milk Products Co., Chicago, Ill.	74.48	25.52	1.49	6.38	8.30	33.8
20516	*Connecticut Valley.* S. Vogel & Sons, Hartford, Conn.	73.74	26.26	1.60	6.64	7.50	33.7
20670	*Connecticut Valley.* S. Vogel & Sons, Hartford, Conn.	....	....	....	....	7.80	....
20423	*Dairylea.* Dairyman's League Cooperative Asso., Inc.	72.14	27.86	1.70	6.76	8.21	36.0
21838	*Dairylea.* Dairyman's League Cooperative Asso., Inc.	74.21	25.79	1.61	6.57	8.13	33.9
21615	*Dairylea.* Dairyman's League Cooperative Asso., Inc.	72.96	27.04	1.59	6.89	5.81	32.8
21651	*Daisy.* Defiance Dairy Products Co., Defiance, Ohio	74.24	25.76	1.58	6.64	7.89	33.7
20415	*Fonda.* Fond du lac, Wis[1]	73.78	26.22	1.58	6.70	7.83	34.0
21626	*Good Luck.* John F. Jelke Co., Huntley, Ill.	74.04	25.96	1.56	6.12	7.72	33.6
21705	*Lee.* H. D. Lee Mercantile Co., Waterbury, Conn.	74.13	25.87	1.66	6.76	7.91	33.7
21623	*Libby's.* Libby, McNeil & Libby, Chicago, Ill.	73.65	26.35	1.56	6.25	7.77	34.1
21633	*Mohican Special.* The Mohican Co., N. Y.	73.64	26.36	1.63	6.38	8.52	34.8
21616	*Nestle's Every Day.* Nestle's Food Co., N. Y.	73.71	26.29	1.54	6.00	7.91	34.2
21685	*Page.* Condensed Milk Co., N. Y.	74.30	25.70	1.57	6.70	7.85	33.5
21618	*Pet.* Helvetia Milk Condensing Co., St. Louis, Mo.	73.69	26.31	1.57	6.38	7.93	34.2
20421	*Pocono.* Jones Bros. Tea Co., N. Y.	73.63	26.37	1.55	6.06	7.56	33.9
21840	*Pocono.* Jones Bros. Tea Co., N. Y.	74.20	25.80	1.65	6.70	7.90	33.7
20412	*Sealect.* Sheffield Condensed Milk Co. Inc., N. Y.	73.91	26.09	1.56	5.93	7.25	33.3
21640	*Sunbeam.* Austin, Nichols & Co., N. Y.	73.88	26.12	1.63	6.95	8.02	34.1
20425	*Van Camp's.* The Van Camp Packing Co. Indianapolis, Ind.	71.28	28.72	1.73	7.72	7.56	36.2
21839	*Van Camp's.* The Van Camp Packing Co., Indianapolis, Ind.	73.23	26.77	1.73	6.64	7.95	34.7
21710	*Van Dyke's.* James Van Dyke Co., N. Y.	74.23	25.77	1.59	6.44	8.04	33.8
26951	[2]*Brand Unknown*	....	....	....	....	8.13	....
	Evaporated Skim Milk.						
21654	*Carolene.* Carolene Products Co.,						

21810. *"400"*. Water 86.01 per cent.; solids 13.99 per cent.; ash 0.59 per cent.; fat (Roese-Gottlieb), 3.21 per cent.; total nitrogen 0.38 per cent.; protein (N. x 6.25), 2.38 per cent.; casein, determined,[1] 1.48 per cent.

21811. *"Angel Drink"*. Water 83.21 per cent.; solids 16.79 per cent.; ash 0.67 per cent.; fat (Roese-Gottlieb), 3.51 per cent; total nitrogen 0.44 per cent.; protein (N. x 6.25), 2.75 per cent.; casein, determined,[1] 1.81 per cent.

Human Milk.

Sixteen samples of breast milk have been examined. The samples were submitted by Visiting Nurse Associations and by physicians. We impress upon those who submit samples that analyses may be very misleading unless the entire secretion of the gland is drawn and thoroughly mixed before sampling. The variations which may occur in different portions of human milk have been noted in a previous bulletin.[2]

Analyses of samples submitted during the year are given in Table XIII.

Table XIII. Analyses of Human Milk.

No.	Solids	Protein, (N. x 6.38)	Fat	Sugar	Ash
	%	%	%	%	%
19973	....	1.83	3.2	....	....
20628	13.45	1.45	4.4	7.60	....
20712	12.85	1.38	4.60	6.67	0.20
20747	15.08	0.94	6.80	7.17	0.17
20749	15.73	1.56	7.0	6.96	0.21
20890	9.97	1.44	1.4	6.88	0.25
21037	.....	1.43	5.5	....	....
21038	13.29	1.29	4.8	6.98	0.22
21362	10.88	1.17	2.4	7.08	0.23
21520	10.00	1.33	1.2	7.23	0.24
21573	.....	....	4.2	....	....
21590	10.17	1.12	1.7	7.10	0.25
21598	11.65	1.23	3.1	7.09	0.23
21723	12.74	1.44	5.0	5.99	0.31
21724	9.51	1.06	1.5	6.73	0.22
21945	....	1.38	3.6	....	....

MEAT PRODUCTS.

Hamburg Steak.

Hamburg steak rapidly deteriorates and develops a tainted or foul odor and an unattractive appearance. To deodorize the product and simulate the red color associated with fresh meat sodium sulphite or other salt of sulphurous acid is frequently employed. The use of sulphites for this purpose is in violation of the provisions of the food law, more particularly in that it conceals damage or inferiority.[3]

[1] Methods of Analysis, A. O. A. C., p. 267.
[2] Conn. Exp. Sta., Bull. 227, p. 255. 1920.
[3] Conn. Reg. 51.

Of fifty-nine samples examined for the Dairy and Food Commissioner, fifteen contained sulphites in amounts ranging from 326 milligrams to over 2,500 milligrams of sulphur dioxide per kilo of sample.

The samples in which this disinfectant was found are as follows:

TABLE XIV. HAMBURG STEAK CONTAINING SULPHITES.

D. C. No.		Sampled at	Sulphites (SO_2), mgms. per kilo.
25623	*Bridgeport,*	Chicago Market	1912.0
25620		Washington Market	865.0
25627	*Derby,*	F. Swist	426.0
25056	*Hartford,*	Hartford Cash Market Co.	834.0
25094	*New Britain,*	S. Welniskey & Sons	749.0
25080	*New Haven,*	A. M. Levine	784.0
25067		Congress Cash Market	1805.0
25618		Georges Market	1657.0
25611		E. Schoenberger & Sons	1281.0
25614		Capitol Market	1262.0
25617		William Miller Co.	326.0
25268	*Norwich,*	S. &. W. Self Service Co.	441.0
24848	*Union City,*	People's Market	1624.0
25626	*Waterbury,*	Waterbury Cash Market	2535.0
25602		Fulton Market	2470.0

A powder, **25630**, used for treating hamburg steak was submitted by the Dairy and Food Commissioner and found to contain sulphur dioxide equivalent to about 96 per cent. sodium sulphite (Na_2SO_3).

SAUSAGE.

The addition of cereal products or other starchy materials to sausage is not an uncommon practice. The purpose is to increase the water-absorbing power of the meat used and to prevent undue shrinkage of the sausage when cooked. Cuts of meat which are fresh and of good quality will contain enough moisture to secure a consistency of the ground sausage stock which will permit it to be readily packed in casings; but inferior sausage stock may be very dry. Because the use of absorbents in such products may readily lead to abuses the amount of starchy material which may be added to sausage is limited by official rulings and the presence thereof must be declared. According to regulations in this State[1], cereal products or other starchy materials added to sausage must be declared and the amount must not exceed 2 per cent. This ruling is in accord with that which is in force with the Federal meat inspection service.

Certain types of sausage, such for example as frankfurts, are frequently packed in artificially colored casings. This practice is permissible[2] if the proper declaration of color is made.

[1] Conn. Regulation 51.

[2] Ibid.

TABLE XV. SAUSAGE CONTAINING EXCESS OF STARCH OR ARTIFICIAL COLOR OR BOTH.

D.C. No.	Dealer	Manufacturer	Remarks.
	Pork Sausage.		
	Hartford.		
25050	Kashmann's Market......	Scholefields, Meriden	Excess starch.
	Naugatuck.		
25250	Naugatuck Valley Market	Own make..........	Excess starch.
	New Britain.		
25071	M. Berkowitz...........	Thos. J. McNamara & Co., Bridgeport	Excess starch.
25073	Mohican Co.............	Thos. J. McNamara & Co., Bridgeport	Excess starch.
	New Haven.		
25063	H. Brown...............	....	Excess starch.
25069	Rice & Gorden..........	....	Excess starch.
25134	Van Dyke Co............	....	Excess starch.
	Waterbury.		
25610	Swift & Co.............	Own make..........	Excess starch.
25606	Washington Market......	Own make..........	Excess starch.
	Frankfurts.		
	Bridgeport.		
25086	The Bridgeport Public Market...............	George Kearns, New York, N. Y.	Color undeclared.
25081	Cudahy Packing Co.......	Own make..........	Excess starch; color undeclared.
25085	Elm City Provision Co....	Own make..........	Excess starch; color undeclared.
24989	Elm City Provision Co....	....	Color undeclared.
25083	Peter Hron..............	Own make..........	Color undeclared.
24987	T. J. McNamara.........	Own make..........	Color undeclared.
24988	T. J. McNamara.........	Own make..........	Color undeclared.
25091	T. J. McNamara.........	Own make..........	Excess starch; color undeclared.
25088	New England Market, Inc.	Own make..........	Excess starch; color undeclared.
	New Britain.		
25072	M. Berkowitz...........	T. J. McNamara & Co., Bridgeport...	Excess starch
	New Haven.		
25075	The Alois Schwabe Co....	Own make..........	Color undeclared.
25078	Cedar Provision Co.......	Own make..........	Color undeclared.
25082	Mrs. C. Hertler..........	Own make..........	Color undeclared.
25076	S. J. Hugo & Sons........	Max Tunz..........	Color undeclared.

TABLE XV. SAUSAGE CONTAINING EXCESS OF STARCH OR ARTIFICAL COLOR OR BOTH—(*Concluded*).

D.C. No	Dealer	Manufacturer	Remarks
	Frankfurts—Concluded.		
	New Haven—Concluded.		
25092	Katz & Winn	Armour & Co., Hartford Branch	Excess starch; color undeclared.
25136	Henry Novicki	Elm City Prov. Co., New Haven	Excess starch.
25079	R. Perri	Elm City Prov. Co., Bridgeport	Excess starch; color undeclared.
25077	Carl Rossler	Own make	Color undeclared.
25074	Sperry & Barnes Co.	Own make	Color undeclared.
	Stamford.		
25275	Klein and Amahle	Own make	Excess starch.
	Waterbury.		
25604	John Hullstrunk	Own make	Excess starch.
25607	Sachsenhauser, Inc.	Own make	Excess starch.
25605	Washington Market	Own make	Excess starch.

Twenty-six samples of pork sausage and forty-nine of frankfurts were submitted by the Dairy and Food Commissioner.

Pork sausage was examined for starch, sulphites and borax. Sixteen samples were passed, nine contained starch in excess of 2 per cent. and one contained less than 2 per cent., but its presence was not declared. No sulphites or borax was found in any of the samples.

Frankfurts were examined for starch, color, sulphites and, in some cases, for borax. In sixteen samples no starchy absorbant was found. Twelve samples contained starch in excess of 2 per cent., fifteen contained 2 per cent. or less and in six the amount was not determined.

Eighteen samples were packed in casings which were artificially colored but in one case (**24696**, Bethel Provision Co.), color was declared. In eighteen no color was found; and in thirteen color was either not tested for or not proven.

Traces of starch possibly derived from spices were disregarded. In the samples examined the minimum amount of starch determined was about 1 per cent (0.94), and the maximum was 5.35 per cent.

A sample of color, D. C. No. **18137**, used by a manufacturer for coloring casings, was identified as Orange I, a permitted coal tar

color. So far as colors in the samples examined were identified they were coal tar colors of the permitted group.

In Table XV are listed samples in which excesses of starch (over 2 per cent.), and artificial color were found. These amounts of starch are not permissible under Regulation 51 even if declared.

TABLE SALT.

The defination and standard for table salt is as follows:

> Table salt, dairy salt, is fine-grained crystalline salt containing, on a water-free basis, not more than 1.4 per cent. of calcium sulphate ($CaSo_4$), not more than 0.5 per cent. of calcium and magnesium chlorides ($CaCl_2$ and $MgCl_2$), nor more than 0.1 per cent. of matters insoluble in water.[1]

To prevent caking when exposed to atmospheric conditions and facilitate free delivery from a shaker, salt is sometimes mixed with starch, or the carbonates of calcium or magnesium.

Twenty-three samples of table salt were collected by the Station agent, including all the familiar brands, and analyses are given in Table XVI. In calculating the probable distribution of constituents, sulphuric acid (So_3) was calculated as calcium sulphate and any excess as magnesium sulphate. If calcium was in excess of sulphuric acid, the excess was calculated as calcium carbonate (if carbonates were indicated), or to calcium oxide (if the solution was alkaline), or to calcium chloride (if the solution was neutral). Excesses, if any, of magnesium over sulphuric acid were calculated as carbonate, oxide or chloride as in the case of calcium. Qualitative tests indicated that phosphates were either not present or present in not more than traces. Actual salt (sodium chloride) was calculated as the difference between 100 per cent. and the sum of the percentages of moisture, iron and aluminum oxides, sulphate, carbonate and chloride of calcium, and carbonate and chloride of magnesium. If the carbonates of calcium and magnesium were not present the per cent. of material insoluble in water was included with the impurities.

Eight samples were slightly under the weight claimed, but the deficiency was less than one ounce per pound, except in one case where it was 1.4 ounces. Fourteen samples contained more than the weight declared. One package was broken and there was some loss of contents.

The price per pound ranged from 1.8 cents to 6.9 cents and the average was 4 cents.

The samples contained from 96.6 per cent. to 99.5 per cent. of pure salt (sodium chloride), the average being 98.2 per cent. On a previous inspection[2] the average sodium chloride was 98.5 per cent.

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[1] Circ. 136, U. S. Dept. Agr., Office of Secretary.

[2] Conn. Exp. Sta. Report 1908, pp. 596-7.

TABLE XVI. ANALYSES OF

Sta. No.	Brand and Manufacturer	Cost per lb.	Carbo dioxid (CO_2)
		cents	
21697	*Benefit.* Direct Stores, Inc., Boston, Mass.	5.0	Preser
20411	*Big 4.* Rock Glen Salt Co., Rock Glen, N. Y.	2.6	None
21649	*Columbia.* International Salt Co., N. Y.	2.4	None
21620	*Crystaline.* Crystaline Salt Co., Ithaca, N. Y.	4.8	Preser
21628	*Diamond.* Diamond Crystal Salt Co., St. Clair, Mich.	6.4	Preser
21689	*Diamond.* Diamond Crystal Salt Co., St. Clair, Mich.	6.9	Preser
21699	*Diamond.* Diamond Crystal Salt Co., St. Clair, Mich.	5.6	None
20406	*Grandmother's.* The Great Atlantic and Pacific Tea Co.	1.8	None
21660	*Iona.* The Great Atlantic and Pacific Tea Co.	1.8	None
21643	*L. B. C.* The Logan Bros. Co., Bridgeport, Conn.	5.1	Presen
21641	*Mardor.* E. C. Greening, Bridgeport, Conn.	5.8	Presen
20407	*Nutmeg.* Miner, Read & Tullock, New Haven, Conn.	5.1	Presen
21676	*Purity.* International Salt Co., Scranton, Pa.	4.8	Presen
20414	*Red Cross.* Independent Salt Co., N. Y.	4.6	Presen
21614	*Remington.* Remington Salt Co., Ithaca, N. Y.	3.4	Presen
21619	*Remington.* Remington Salt Co., Ithaca, N. Y.	2.4	None
21708	*Remington.* Remington Salt Co., Ithaca, N. Y.	3.2	None
21631	*Sunbeam.* Austin, Nichols & Co., Inc., N. Y.	5.0	Presen
20422	*U. S.* The Union Salt Co., Cleveland, Ohio.	2.6	Presen
20408	*Watkin's.* The Watkins Salt Co., Watkins, N. Y.	3.2	None
20420	*White Lily.* The Wadsworth Salt Co., Wadsworth, Ohio.	3.0	Presen
21624	*Worcester.* Worcester Salt Co., N. Y.	3.4	None
20405	*Yorkshire.* International Salt Co., N. Y.	2.4	None

The moisture content was inconsiderable and did not exceed 0.5 per cent. in any case. Material insoluble in water was generally within the limits of the standard except where material had been added to prevent caking. In eleven samples such added material was declared on the labels of the packages. In two cases the insoluble matter was about 0.5 per cent. in each case due to carbonates of calcium and magnesium of which there was no declaration. The amount of calcium sulphate did not exceed the limit of the standard 1.4 per cent. and the sum of the percentages of calcium and magnesium chlorides was less than 0.5 per cent. in all cases. Sample **21697** appears to contain calcium carbonate instead of magnesium carbonate and in **21676** somewhat more than the 1 per cent. declared was found.

SALAD DRESSING.

There is no official definition or standard for salad dressing but, in general practice, the product contains an edible oil, eggs, vinegar and spices. Sugar and starchy materials may also be present. Eggs appear to be an essential constituent in the dressing known as mayonnaise according to most recipes.

TABLE SALT.

isture	Insoluble in water	Iron and Aluminum (Fe_2O_3. Al_2O_3)	Calcium Sulphate ($CaSO_4$)	Calcium Carbonate ($CaCO_3$)	Calcium Chloride ($CaCl_2$)	Magnesium Carbonate ($MgCO_3$)	Magnesium Chloride ($MgCl_2$)	Sodium Chloride (NaCl), by difference	Sta. No.
%	%	%	%	%	%	%	%	%	
.26	1.74	0.02	0.83	1.71	....	0.15[1]	....	97.03	21697
.18	0.15	0.01	0.70	....	....	....	....	98.84[2]	20411
.46	0.01	0.00	0.73	....	0.11	....	0.05	98.64	21649
.40	0.56	0.02	1.36	0.07	....	0.58[3]	....	97.57	21620
.22	0.69	0.08	0.14	0.10	....	0.81[3]	....	98.65	21628
.20	0.59	0.04	0.15	0.09	....	0.94[1]	....	98.58	21639
.14	0.00	0.01	0.22	....	0.08	....	0.02	99.53	21699
.23	0.04	0.01	1.09	....	0.14	....	0.01	98.48	20406
.22	0.02	0.01	1.05	....	0.11	....	0.02	98.57	21660
.39	0.91	0.06	0.82	0.15	....	0.90[3]	....	97.68	21643
.38	0.95	0.03	0.82	0.18	....	0.92[3]	....	97.67	21641
.43	0.92	*0.01*	*0.97*	*0.16*	....	*0.98*[3]	....	*97.45*	*20407*
.41	1.52	0.02	1.16	0.16	....	1.65[1]	....	96.60	21676
.30	0.64	0.01	0.71	0.12	....	0.79[3]	....	98.07	20414
.32	0.60	0.01	1.02	0.15	....	0.60[3]	....	97.90	21614
.32	0.01	0.01	1.00	....	0.15	....	0.02	98.49	21619
.21	0.02	0.00	0.66	....	0.10	....	0.01	99.00	21708
.43	0.73	0.14	0.85	0.18	....	0.49[3]	....	97.91	21631
.15	0.53	0.01	0.53	0.54	....	0.15	....	98.62	20422
.43	0.00	0.01	1.02	....	0.12	....	0.02	98.40	20408
.32	0.47	0.01	1.19	0.11	....	0.47	....	97.90	20420
.22	0.02	0.01	0.60	....	0.11	....	0.02	99.02	21624
.36	0.02	0.01	0.61	....	0.21	....	0.05	98.74	20405

[1] One per cent. magnesium carbonate declared.
[2] Calcium and magnesium as oxides 0.12 per cent.
[3] Added magnesium carbonate declared.

Analyses of a number of commercial salad dressings have been given in a previous report[1] and during the past year further inspection has been made. Twenty-eight samples were collected by the Station agent and analyses are given in Table XVII.

The methods employed are substantially as suggested by Lepper[2] except that "fat" was determined by a modified Roese-Gottlieb method as employed in the work on alimentary pastes and alcohol-ether-soluble P_2O_5 was determined upon the fat thus extracted.

The analyses show that five samples contained relatively little oil (4.3 to 12.8 per cent.), and that in all of these starchy material was present. Starch was also present in two samples where the oil approached 50 per cent., but it was not found in any case where the oil content was over 50 per cent. Moisture varied widely.

The identity of the oils used was not established beyond the fact

[1] Conn. Exp. Sta., Report for *1911*, p. *151*.
[2] Jour. Assoc. Official Agr. Chemists, *5*, 248. 1921.

TABLE XVII. ANALYSES OF

Sta. No.	Brand, Manufacturer or Dealer	Constants of Fat: Refraction, Butyroref. at 25° C.	Constants of Fat: Halphen test
20396	*A. & P.* Atlantic & Pacific Tea Co.	67.0	Positive
15677	*Benefit.* Direct Importing Co., Boston	65.0	?
15671	*Blue Ribbon.* Richard Hellman, Inc., Long Island City, N. Y.	69.0	Positive
20393	*Booth's.* M. W. Booth Co., Meriden, Conn.	70.5	Negative
20395	*Canton-Maid.* Canton-Maid Products Co., Canton, Ohio	67.0	Positive
20394	*Challenge.* The Challenge Products Co., New Haven, Conn.	66.3	Positive
20224	*Country Club.* Svirdoff & Brochin, New Haven, Conn.	67.5	Positive
15675	*Crubro.* Cruikshank Bros. Co., Pittsburgh, Pa.	67.2	Negative
20400	*Easton's.* Gilbert J. Easton, Newark, N. J.	70.0	Negative
20389	*El-Food.* Elizabeth Food Products Co., Elizabeth, N. J.	67.0	Positive
20388	*Empire.* Empire Delicatessen Co., Hartford, Conn.	66.3	Positive
20398	*French's.* F. C. Bushnell & Co., New Haven, Conn.	68.0	Positive
20223	*Gelfand's.* Gelfand Co., Baltimore, Md.	70.1	Negative
20399	*J. Gilbert's.* John Gilbert & Son, New Haven, Conn.	67.0	Positive
20386	*Howard's.* J. G. Howard, Haverhill, Mass.	67.0	Positive
20390	*I-Car-De.*[1] Jas. A. Aicarde & Sons, Boston, Mass.	67.7	Positive
20392	*Libby's.* Libby, McNeill & Libby, Chicago, Ill.	68.0	Negative
15680	*My Wife's.*[1] Fred Fear, Bloomsburg, Pa.	71.2	Positive
15674	*Our Best.*[1] W. W. Walker Co., Hartford, Conn.	67.5	Positive
15679	*Picnic Lunch.* E. R. Durkee & Co., New York City	68.0	Positive
20402	*P. & T.* Park & Tilford, N. Y.	67.0	Positive
15672	*Premier.* Francis H. Leggett & Co., N. Y.	67.2	Positive
20401	*Puro.* F. G. Crombie, Bridgeport, Conn.	69.0	Positive
20403	*Riker's.* Liggett's Drug Stores, New York	70.1	Positive
20385	*Seidner.* Otto Seidner, Westerly, R. I.	67.5	Positive
15681	*Sunbeam.*[1] Austin, Nichols & Co., Inc., New York	67.0	Positive
20397	*Van Camp's.* Van Camp Packing Co., Indianapolis, Ind.	67.0	Positive
20225	*Wallacks'.* M. R. Wallack & Co., New Haven, Conn.	68.0	Positive

that cottonseed oil was present in three-fourths of the total number. Borax was not found.

Assuming 1.38 per cent. of lipoid-P_2O_5 in the dry matter of whole egg the analyses indicate the presence of egg approximately

[1] Labeled Mayonnaise.

SALAD DRESSING.

Moisture	Ash	Protein, (N x 6.25)	Carbohydrate (including fiber by diff.)	"Fat" (alcohol-ether extract)	Salt (NaCl)	Lipoid-P_2O_5	Nitrogen	Total acidity (as acetic acid)	Starch	Sta. No.
39.95	2.21	1.88	12.05	43.91	1.93	0.024	0.30	1.23	1.58	20396
74.37	2.25	3.94	15.17	4.27	1.49	0.034	0.63	1.32	3.87	15677
10.85	0.91	1.88	0.26	86.60	0.70	0.037	0.22	0.39	None	15671
13.29	1.70	1.69	5.25	78.07	1.41	0.023	0.27	0.39	None	20393
12.42	1.30	1.38	1.48	83.42	0.75	0.032	0.22	0.42	None	20395
20.49	1.67	1.19	4.67	71.98	1.43	0.016	0.19	0.48	None	20394
13.55	1.53	2.19	2.97	79.76	1.18	0.050	0.35	0.38	None	20224
68.53	3.16	1.38	14.09	12.84	2.73	0.005	0.22	1.92	2.01	15675
13.63	1.60	1.38	0.36	80.36	1.31	0.051	0.22	0.36	None	20400
37.57	3.32	3.13	1.41	54.57	2.77	0.080	0.50	1.14	None	20389
24.18	0.73	1.06	0.98	73.05	0.60	0.014	0.17	0.96	None	20388
31.51	2.46	3.75	0.48	61.80	1.98	0.109	0.60	0.84	None	20398
15.75	0.87	1.88	0.13	81.37	0.56	0.057	0.30	0.54	None	20223
10.70	0.91	1.19	0.00	87.20	0.43	0.051	0.19	0.39	None	20399
38.06	3.03	4.13	1.19	53.60	2.15	0.056	0.66	1.50	None	20386
21.03	1.37	3.94	6.85	66.81	0.81	0.162	0.63	0.54	None	20390
72.58	3.49	4.50	12.39	7.04	2.60	0.030	0.72	2.46	0.63	20392
72.83	3.72	2.06	11.71	9.68	3.27	0.004	0.33	0.71	2.41	15680
15.98	0.93	2.75	5.21	75.13	0.56	0.061	0.44	0.45	None	15674
40.85	6.62	4.69	15.24	32.60	5.72	0.031	0.75	1.68	0.82	15679
28.93	2.12	1.50	6.34	61.11	1.72	0.040	0.24	0.54	None	20402
40.16	3.00	3.75	0.09	53.00	2.37	0.140	0.60	1.38	None	15672
15.86	1.77	1.69	2.91	77.77	1.29	0.008	0.27	0.45	None	20401
72.87	3.53	2.56	12.41	8.63	2.22	0.041	0.41	0.60	3.29	20403
18.08	1.95	2.13	4.51	73.33	1.59	0.019	0.34	0.48	None	20385
38.33	2.02	2.75	None	56.92	1.49	0.098	0.44	0.48	None	15681
38.90	3.14	4.81	2.48	50.57	2.49	0.078	0.77	1.44	None	20397
16.45	1.83	1.44	3.76	76.52	1.49	0.003	0.23	0.54	None	20225

equivalent to from 1 to 10 per cent. of dry, whole egg material (.014 to .162 per cent. lipoid-P_2O_5), in the dressings as sold. This is disregarding three samples where the lipoid-P_2O_5 was less than 0.01 per cent. and assuming that the cereal or other starchy matter present does not appreciably increase the lipoid-P_2O_5. Comparison on the water-free basis of five samples labeled,

"Mayonnaise", viz., **15675, 20390, 15680, 15674** and **15681,** shows that the lipoid-P_2O_5 varies from 0.014 to 0.205 per cent. Many dressings not claimed to be of this type show amounts of lipoid phosphorus which equal or exceed these limits.

SYRUP, ETC.

A sample of brown sugar, **21584** and one of sugar syrup, **21585,** submitted by a consumer were examined for ash and total sugars.

21584. Ash 0.46 per cent.; sucrose (by polarization), 98.32 per cent.
21585. Ash 5.51 per cent.; invert sugar 25.60 per cent.; sucrose (increase in reduction after hydrolysis), 38.87 per cent.

The samples were of normal composition and quality.

A sample of *Green's Muscadine Punch,* **21206,** submitted by a consumer was examined as follows:

Total solids 62.24 per cent.; ash .014 per cent.; alcohol trace (2 per cent. by wt.); invert sugar 31.80 per cent.; sucrose (by increase in reduction after hydrolysis), 29.49 per cent.; preservative (other than sugar), none found; saccharin none found; color permitted coal tar, Guinea Green B and Amaranth identified.

This is a syrupy fruit flavor base to be diluted for beverage purposes.

VINEGAR.

The legal standard for cider vinegar in the State requires 4 per cent acidity (as active acid) and 1.6 per cent. of cider vinegar solids.[1]

Six samples were submitted by the Dairy and Food Commissioner one of which was unofficial. All met the requirements of the standard and other constituents so far as determined were normal.

Seven samples were examined for producers or other individuals; three were below requirement as to solids, but all substantially met the required degree of acidity.

MISCELLANEOUS MATERIALS EXAMINED CHIEFLY FOR POISONS.

Eighteen samples of miscellaneous materials were submitted by health officers, veterinarians and others to be examined for poisons. In thirteen cases no poisons were detected. The remaining five may be cited as follows:

20893. *Hens* which had died under suspicious circumstances. Submitted by the health officer, Town of Stratford. An appreciable amount of yellow phosphorus was found.

19769. *Material* thought to have caused death of several cows. Submitted by request of Dr. Thompson of Sharon. The material contained about 10 per cent. of arsenate of lead.

[1] Sec. 2459, General Statutes of Connecticut.

20515. *Poisoned bait.* Submitted by Mr. Titcomb, State Board of Fisheries and Game. Chromium was found.

20569. *Dog's stomach contents.* Submitted by B. W. Kenneson, State Police Barracks, Canaan. Strychnine was identified.

21303. *Wine made in galvanized tub.* The wine contained zinc (ZnO), in the amount of 370 parts per million which is considerably more than the amount allowed (100 parts), in foods where limits for metallic impurities are recognized. Recently attention has been called[1] to instances of poisoning apparently arising from eating foods cooked in galvanized iron utensils; and it was shown that certain acid beverages dissolved large amounts of zinc from galvanized containers in which the liquids had been allowed to stand.

II. DRUGS.

PREPARATIONS RECOGNIZED IN THE UNITED STATES PHARMACOPOEIA OR THE NATIONAL FORMULARY.

All samples of drugs were submitted by the Dairy and Food Commissioner unless otherwise stated.

SOLUTION OF AMMONIUM ACETATE.

Solution of ammonium acetate is an aqueous solution containing not less than 7 per cent. of ammonium acetate, $NH_4C_2H_3O_2$.[2]

Sixteen samples were examined. Two of these, viz., **26561**, purchased of the Clark and Brainerd Co., New Britain and **25417**, purchased of Curran and Flynn, Willimantic, contained 5.55 and 5.28 per cent. of ammonium acetate respectively and were below standard. Thirteen samples satisfied the requirements of the Pharmacopoeia and one was not analyzed because of leakage in transit.

GLYCERITE OF BISMUTH.

This preparation should contain not less than 0.640 gram of bismuth oxide (Bi_2O_3), in each 5 cc. of solution.[3]

Two samples were examined, both of which were below the requirement. No. **26553**, the Dickenson Drug Co., New Britain, contained 0.468 gm. Bi_2O_3 and **25399**, W. E. LaBelle, Est., Danielson, contained 0.442 gm. in 5 cc.

CITRATED CAFFEINE.

Citrated caffeine contains, when dried to constant weight at 80° C., not less than 48 per cent. of anhydrous caffeine.[4]

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[1] Jour. Ind. Eng. Chem., **16**, 164. 1924.
[2] U.S.P. IX, p. 237.
[3] N. F. IV, p. 95.
[4] U.S.P. IX, p. 86.

Sixteen samples were submitted. Five contained 48 per cent. or over of anhydrous caffeine. Eleven did not fully meet the standard of 48 per cent., but they contained over 90 per cent. of the required amount. The assays ranged from 43.8 to 49.6 per cent. of anhydrous caffeine of the correct melting point, viz., 235°-236°.

Tincture of Ginger.

Under the prohibition regulations tincture of ginger made according to the formula given in the United States Pharmacopoeia is held to be intoxicating liquor. If made double strength, however, it is classed as unfit for beverage purposes.[1] Unfortunately the Pharmacopoeia does not give the minimum amount of extractives in the official preparation; it merely says that the residue on drying does not *exceed* 2 per cent. Data from various sources[2] indicate that the solids in the U. S. P. tincture may vary from about 1 to 2 per cent. A preparation of double strength tincture[3] contained 2.46 grams solids per 100 cc. or about 3 per cent.

The sample submitted, **25324**, contained 1.3 per cent. of solids which, judging by the data cited, is too low for double strength.

Hydrobromic Acid, Diluted.

Diluted hydrobromic acid is an aqueous solution containing not less than 9.5 per cent. nor more than 10.5 per cent. of hydrobromic acid (HBr)[4].

The three samples examined contained from 10.2 per cent. to 10.6 per cent. of hydrobromic acid and conformed substantially to the official requirement.

Hypophosphorous Acid, Diluted.

Diluted hypophosphorous acid is an aqueous solution containing not less than 9.5 per cent. and not more than 10.5 per cent. of hypophosphorous acid (HPH_2O_2).[5]

One sample submitted was of standard quality. It contained 10.24 per cent. of HPH_2O_2.

Tincture of Iodine.

Tincture of iodine is an alcoholic solution containing in 100 cc. not less than 6.5 gms. nor more than 7.5 gms. of iodine and not less than 4.5 gms. nor more than 5.5 gms. of potassium iodide.[6]

Of seventy-six samples submitted only six were substantially outside the limits of the standard.

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[1] Treasury Decision 3092.

[2] Conn. Exp. Sta. Report, 1910, p. 499; Lythgoe & Nurenberg, Jour. Ind. Eng. Chem., Dec. 1911; Snyder, Am. Jour. Pharmacy, Apr. 1918.

[3] Randolph & Beringer, Jour. Am. Pharm. Asso., Jan. 1924.

[4] U.S.P. IX, p. 12.

[5] U.S.P. IX, p. 16.

[6] U.S.P. IX, p. 457.

Five were below in one or both particulars and one contained a large excess of iodine.

Four samples purchased by the Station agent in department stores were of satisfactory quality and were passed.

TABLE XVIII. ASSAYS OF TINCTURE OF IODINE.

D. C. No.	Sampled at	Grams per 100 cc. Iodine	Grams per 100 cc. Potassium iodide
26564	*Bristol.* Rickman's Economy Drug Store	17.52	5.86
26624	*Hartford.* Turgeon Drug Co.	5.95	3.61
26664	*Middletown.* Hartman Drug Co.[1]	6.13	3.80
26556	*New Britain.* Miller Hanson Drug Co.	3.91	2.93
26586	*Rockville.* John J. Lee	5.90	3.57
26588	E. F. Wilson[2]	5.25	3.84

CITRATE OF MAGNESIA.

An unofficial sample of citrate of magnesia, **24387,** contained 0.79 gm. magnesium oxide (MgO), per 100 cc which is about one-half the amount required for the pharmacopoeial preparation.[3] The sample contained a large amount of sediment indicating impure ingredients or careless preparation or both.

MAGNESIA MAGMA.

(MILK OF MAGNESIA).

Magnesia magma yields not less than 6.5 per cent. nor more than 7.5 per cent. of magnesium hydroxide, $Mg(OH)_2$.[4]

Forty-three samples submitted by the Dairy and Food Commissioner and one purchased by the Station agent were examined of which twenty-eight satisfied the requirements of the standard or conformed substantially thereto. One sample was less than one-half strength and fifteen contained considerably more than the maximum of 7.5 per cent. The deficient sample and those containing excesses greater than 10 per cent. of the maximum limit are listed in Table XIX.

TABLE XIX. ASSAYS OF MAGNESIA MAGMA.

D. C. No.	Sampled at	Manufacturer	Magnesium Hydroxide $Mg(OH)_2$ %
25919	*Bridgeport.* Hindle Druggist	Sharp & Dohme	11.10
25922	F. S. Porter	Lilly	10.20
26565	*Bristol.* The Madden Drug Store	Phillips, N. Y.	8.41
26622	*Hartford.* G. Fox & Co.	Lilly	9.50
26575	Louis K. Liggett Co.	Liggett	8.99
26663	*Middletown.* United Chemists Co.	United Chemists	8.61
26660	The Woodard Drug Co.	Phillips	8.64

[1] Manufactured by Felborn Pharmacal Co.
[2] Manufactured by Adelphi Mfg. Co., Brooklyn, N. Y.
[3] U. S. P. IX, p. 248.
[4] U. S. P. IX, p. 261.

TABLE XIX. ASSAYS OF MAGNESIA MAGMA—*Concluded.*

D. C. No.	Sampled at	Manufacturer	Magnesium Hydroxide $Mg(OH)_2$
26551	*New Britain.* The Dickinson Drug Co.	Phillips	8.47
26555	The Miller Hanson Drug Co.	Phillips	8.56
25392	*Putnam.* E. H. Burt	....	8.61
25390	Geo. A. Dresser	....	8.53
26596	*So. Manchester.* Geo. E. McNamara Drug Co.	Phillips	8.50
26590	J. H. Quinn & Co.	Sharp & Dohme	2.80
26580	*Stafford Springs.* D. H. McCormick	Phillips	8.94
26727	*Torrington.* Park Pharmacy	Brewer & Co., Inc.	8.91
26615	*Windsor.* Robert H. Barnes	Norwich Pharmacal Co.	8.75

SPIRIT OF NITROUS ETHER.

(SWEET SPIRIT OF NITRE).

Spirit of nitrous ether is an alcoholic solution containing not less than 3.5 per cent. nor more than 4.5 per cent. of ethyl nitrite $(C_2H_5\text{-}NO_2)$.[1]

This preparation deteriorates and it is directed to keep it in small, well-stoppered containers, in a cool place and protected from light.

Forty-eight samples were examined, thirty-five of which were passed as conforming entirely or substantially to the standard. Thirteen were deficient, containing from 1.4 to 3.1 per cent. of ethyl nitrite.

The preparations were frequently labeled 4 per cent. or 18 mins. ethyl nitrite per fluid ounce. Eighteen minims is about 3.6 cc per 100 cc of solution or (taking the specific gravity of ethyl nitrite as 0.9), 4 grams per 100 cc of solution. Assuming the specific gravity of the finished solution to be 0.823 (25°C), the percentage of ethyl nitrite is about 4.9.

Samples containing substantially less ethyl nitrite than the minimum required by the Pharmacopoeia are listed in Table XX.

TABLE XX. ASSAYS OF SPIRIT OF NITROUS ETHER.

D. C. No.	Sampled at	Manufacturer	Ethyl nitrite %
25397	*Danielson.* W. E. LaBelle, Est.	....	2.58
26634	*East Hartford.* The O'Connell Drug Co.	Sisson Drug Co.	2.75
26649	*Meriden.* W. W. Mosher	Powers, Weightman & Co.	3.13
26650	Pink's Pharmacy	Preston Chemical Co.	1.90
26658	*Middletown.* Lincoln Drug Co.	Mallinckrodt	1.96
26802	*Norwich.* James H. Dunn	....	1.40
26593	*So. Manchester.* T. Weldon & Co.	Felborn Pharm. Assoc.	3.02
26578	*Stafford Springs.* D. H. McCormick	....	2.90
25932	*Stamford.* C. S. Finch, Druggist	United Drug Co.	3.13
26730	*Thomaston.* George A. Lemmon	United Drug Co.	2.88
26737	*Waterbury.* R. E. Holmes	Conn. Chem. & Dis. Co.	3.01
26720	*Winsted.* Apothecaries Hall	Gibson-Howell Inc.	2.80

Solution of Potassium Hydroxide.

This preparation is an aqueous solution containing not less than 4.5 per cent. of potassium hydroxide (KOH).[1]

The solution readily absorbs carbon dioxide from the air and should be securely stoppered.

Five samples were submitted, four of which exceeded the standard. One was slightly deficient containing 3.98 per cent. of potassium hydrate.

Solution of Sodium Hydroxide.

This solution should contain not less than 4.5 per cent. of sodium hydroxide (NaOH).[2] Like potassium hydroxide solution it readily absorbs carbon dioxide and should be kept in bottles provided with rubber stoppers or with glass stoppers coated with paraffin.

Three samples were examined all of which were of satisfactory strength.

Witch Hazel Water.

Forty-one samples of witch hazel water were examined for the Dairy and Food Commissioner and eleven were collected by the Station agent chiefly from department stores. Examination was made with reference to alcoholic strength, presence of wood alcohol and residue on evaporation.

Of the total number forty-eight were passed as conforming substantially to the requirements of the Pharmacopoeia.

Witch hazel water prepared according to the Pharmacopoeial formula and sold under the name recognized in that text should be made with pure alcohol. A number of samples have been found, however, which were evidently made with specially denatured alcohol. Such preparations should not be labeled in any way to confuse them with the official preparation of witch hazel. It should be made clear that they are not U. S. P. products and the fact that denatured alcohol has been used should be declared.

Four samples by reason of excessive residues[3] on evaporation were not official witch hazel water. Two contained alkaloids identified in one case as quinine. The sample in which quinine was identified was labeled "Double Distilled Hamamelis Virginica or Witch Hazel." While this is not the language of the title recognized in the Pharmacopoeia it suggests it closely enough to constitute a design or device which would mislead a purchaser to believe that the product is "witch hazel water" or "distilled extract

[1] U. S. P. IX, p. 252.
[2] U. S. P. IX, p. 255.
[3] U. S. P. IX, 58. Not more than 0.025 gm. residue per 100 cc allowed.

of witch hazel" which it is not in that it contains at least one substance (quinine) which is foreign to witch hazel water.

The samples not conforming to the Pharmacopoeial requirements are as follows:

TABLE XXI. ANALYSES OF WITCH HAZEL WATER.

No.	Sampled at	Manufacturer	Solids, gm. per 100 cc.
D. C. 26550	*Hartford.* G. Codrado..........	Amendola Bros., New Haven	0.072[1]
Sta. 21663	*New Haven.* Gamble-Desmond Co.	....	0.232
D. C. 25436	*New London.* T. H. Stead.......	....	0.052[2]
D. C. 25439	L. P. Desmarais...	....	0.152

PROPRIETARY PREPARATIONS.

Two samples of medicated wine were examined.

19639. *Horke Vino,* bottled by T. F. Murray Co., Inc., Bridgeport, Conn., and **19640,** Trainer's American Elixir of Bitter Wine. (*Horke Vino*).

Analyses are as follows:

19639. Solids 3.62 gms. per 100 cc; ash 0.032 gms. per 100 cc; alcohol 19.14 per cent. by volume; emodin-like substances present; alkaloids none found.

19640. Solids 7.37 gms. per 100 cc; ash 0.38 gms. per 100 cc; alcohol 16.10 per cent. by volume; emodin-like substances present; alkaloids none found; phosphates, sulphates and magnesium present in ash.

Sample **19639** was slightly bitter to the taste and **19640** was more decidedly so.

It has been often suggested that the chief physiological effect of many so-called tonics is due to the stimulative action of the alcohol which they contain and in some cases astonishing quantities of such preparations may be consumed by a "patient"[3] who has developed the habit. Under the prohibition law the status of such remedies becomes of particular interest. The question hinges upon (a) whether the preparation in question contains medicament enough to preclude its use as a beverage;[4] (b) whether it contains more than enough alcohol to hold medicaments in solution or to act as a preservative.

In the absence of official ruling in particular cases[5] the question of beverage quality may be debatable unless the product has been rendered completely non-drinkable by bitter, astringent, nauseating or poisonous substances. Thus tincture of Jamaica ginger would seem to be clearly a non-beverage article but prohibition authorities have found it necessary to require that this

[1] Contains quinine.
[2] Alkaloids indicated.
[3] See Jour. Am. Med. Assoc., April 9, 1921, p. 1029.
[4] Webster's Dictionary defines "beverage" as "drink;" that which is drunk; especially a pleasant or refreshing drink, or an habitual one."
[5] The Internal Revenue Department holds certain U. S. P. and N. F. preparations fit for beverage purposes.

preparation shall only be made of double the ordinary strength and even then sold under rigid restrictions.

To determine whether the two wines under examination contained medicaments not immediately evident to the taste but which might produce subsequent effects which would tend to destroy their beverage character the following experiment was tried.

Two to four times the dose recommended to be taken at one time, *viz.*, two to four ounces, was freed from alcohol and fed to two human subjects. In the case of **13539** no effects were noted with the smaller amount and only mild cathartic action with the larger dose. With sample **13640** the cathartic effect of the smaller dose was more marked beginning in about three hours and extending over a period of eight hours. No other effects were experienced in either case by either subject.

As to whether the amount of alcohol present was in excess of the amount necessary to hold medicaments in solution the following trials were made to furnish at least the basis for an opinion.

Twenty-five cc of each sample were taken and the alcohol largely removed by successive dilutions and evaporations taking care not to reduce the volume below the original volume taken. These dealcoholized portions and equal volumes of the original samples were then transferred to Hortvet tubes centrifuged and the amounts of sedimentary material compared. With sample **13639** there was no appreciable difference between the original solution and the dealcoholized solution. With **13640** the amount of insoluble matter was considerably greater in the solution which had been freed from alcohol.

As to the necessity for alcohol, in the amounts found, for preservative purposes it was regarded as significant that dealcoholized residues from these samples when allowed to stand at summer temperature (80° to 90°F), exposed to the air for five days or longer developed no mould and showed no signs of decomposition. An aqueous solution can be adequately protected against decomposition in the sealed package by proper sterilization; and if these tonics are taken according to directions they will last only about six days. There appears to be no evident necessity for a preservative but if one is required, one-tenth per cent. of benzoate of soda would serve the purpose.

In case of **13639** it appears that the tonic might be used as a beverage, that the alcoholic content is in excess of the amount necessary to hold medicaments in solution and that alcohol is not necessary as a preservative. As for **13640,** in view of the results obtained, doubt might be raised as to the excess of alcohol and, possibly also, as to its beverage qualities.

21848. *Rheuma.* Anti-rheumatic, diuretic, demulcent and laxative. Made by the Rheuma Co., Buffalo, N. Y., and Walkerville, Ont. It is cautioned not to use large doses as a cathartic.

Examination was made as follows:

Brown liquid with considerable sediment; acid to litmus; odor of turpentine; taste bitter; solids 10.53 per cent.; ash 3.87 per cent.; salicylic acid

5.06 per cent.; iodine 0.69 per cent.; potassium oxide 0.90 per cent.; potassium iodide (calc. from iodine), 0.90 per cent.; digitalis glucosides indicated?; alkaloids none found; tannin, citrates, tartrates, none found.

The preparation consists of, or contains, salicylic acid, potassium iodide, probably turpentine and possibly also digitalis glucosides.

MISCELLANEOUS DRUGS, ETC.

AMMONIA WATER.

(HOUSEHOLD AMMONIA).

Twenty-four samples of ammonia water for laundry and household use were collected by the Station agent. The samples were purchased in grocery and department stores. There is no standard for this article and very few of the samples examined approach in ammonia (NH_3) content the minimum strength of ammonia water as prescribed in the United States Pharmacopoeia viz., 9.5 per cent. The lowest ammonia content found was 1.3 per cent. and the highest was 8.3 per cent. The average strength was 4.5 per cent.

Ammonia water, presumed to be of the strength demanded by the Pharmacopoeia and purchased from druggists, was examined last year[1] and of twenty-four samples ten were less than 90 per cent. of the required strength the deficient samples containing from 2.5 to 8.4 per cent. of ammonia (NH_3). On the average, household ammonia samples examined were about one-half as strong as pharmacopoeial ammonia water; on the other hand, judging from the results cited, five out of every twelve purchases of ammonia water in drug stores will be no stronger than the product for household use.

Partial analyses of the samples examined during the past year are given in Table XXII.

"POWDERED AMMONIA."

A sample of so-called powdered ammonia, **21679**, made by T. H. Britt Ammonia Co., Milwaukee, Wis., was examined as follows:

21679. Insoluble in acid trace; iron and aluminum none; phosphoric acid (P_2O_5), none; ammonia (NH_3), by distillation, 0.97 per cent.; calcium CaO, 0.45 per cent.; magnesium (MgO), 0.45 per cent.; sulphuric acid (SO_3), 3.75 per cent.; chlorine 20.75 per cent.; carbonate (CO_2), present.

The probable combinations were calculated to be as follows:

Ammonium chloride 3.05 per cent.; sodium chloride 30.88 per cent.; calcium sulphate 1.38 per cent.; magnesium sulphate 2.75 per cent.; sodium sulphate 8.93 per cent.; sodium carbonate 33.60 per cent.; sodium bicarbonate 13.69 per cent.; moisture and undetermined 5.72 per cent.

[1] Conn. Exp. Sta. Bull. 248, p. 437 1923.

TABLE XXII. ANALYSES OF HOUSEHOLD AMMONIA.

Sta. No.	Brand, Manufacturer or Dealer	Sp. Gr. at 20° C	Total solids	Ash	Ammonia (NH_3)
			%	%	%
21700	*Polo.* Austin, Nichols & Co., New Haven, Conn.	0.9870	0.130	0.040	3.13
21645	Bridgeport Public Market, Bridgeport, Conn.	0.9890	0.038	0.022	2.60
21639	*Parson's.* Columbia Chemical Works, New York	0.9640	0.134	0.066	8.83
21657	Economy Grocery Co., New Haven, Conn. .	0.9695	0.014	0.010	7.42
21696	*Hartshorn.* Economy Grocery Co., Hartford, Conn.	0.9755	0.013	0.007	5.66
21637	*Empire.* Empire Bottling Works, Newark, N. J.	0.9875	0.032	0.024	3.16
21677	*A & P.* The Great Atlantic & Pacific Tea Co., New London, Conn.	0.9740	0.010	0.007	6.12
21647	Great Northern Pacific Grocery Co., Bridgeport, Conn.	0.9724	0.119	0.037	6.65
21678	*Gold Seal.* Ideal Chemical Co., Boston, Mass. .	0.9930	0.016	0.008	1.81
21684	*Red Cap.* C. M. Kimball Co., Winthrop, Mass.	0.9660	0.104	0.036	8.13
21635	*Hartshorn.* S. S. Kresge, New Haven, Conn. . .	0.9854	0.066	0.024	3.56
21833	C. S. Leete, New Haven, Conn.	0.9880	0.026	0.009	2.91
21658	Logan Bros. Co., New Haven, Conn.	0.9712	0.035	0.022	6.75
21702	*Hartshorn.* N. Y. Butter Co., Waterbury, Conn.	0.9806	0.032	0.025	4.54
21681	*Fortified.* Salem Chemical & Supply Co., Salem, Mass.	0.9838	0.076	0.063	4.02
21653	Shelton Ave. Delicatessen, New Haven, Conn.	0.9884	0.115	0.054	2.97
21667	*Polo.* Stoddard, Gilbert & Co., New Haven, Conn.	0.9950	0.029	0.016	1.31
21638	*Sun.* Sun Chemical Co., Roslindale, Boston, Mass.	0.9646	0.113	0.035	8.67
21713	*Leslie's.* The Arthur Leslie Co., New York. . . .	0.9930	0.018	0.015	1.78
21695	*Capitol.* The Capitol Pickling Wks., Hartford, Conn.	0.9924	0.012	0.008	1.78
21650	United Grocery Co., Bridgeport, Conn.	0.9790	0.106	0.034	4.97
21636	*Hartshorn.* F. Woolworth, New Haven, Conn. .	0.9910	0.026	0.024	2.32
21701	*Eagle.* F. Woolworth, Waterbury, Conn.	0.9778	0.012	0.010	5.16
21707	*Hartshorn.* Yate Tea & Coffee Co., Waterbury, Conn.	0.9850	0.063	0.030	3.42
	Minimum	0.9950	0.010	0.007	1.31
	Maximum	0.9640	0.134	0.066	8.83
	Average	0.9813	0.056	0.026	4.49

With less than one per cent. of ammonia (NH_3) in the product there is no justification for calling it "powdered ammonia." Soda ash (sodium carbonate), is a common constitutent of cleaning compounds.

UNCLASSIFIED.

19938. *Ointment.* The sample was found to be essentially a mixture of petrolatum and saponifiable fat medicated with methyl salicylate and menthol.

21256. *Deeva Soap.* Lye-less Soap Corporation, N. Y. It is claimed that the soap liberates no free lye in contact with water. It was examined as follows:

Moisture (at 110° C), 20.16 per cent.; free fatty acids 15.59 per cent.; combined fatty acids 52.91 per cent.; free sodium carbonate 2.00 per cent.; alkali combined as soap (as Na_2O), 7.83 per cent.; sodium chloride 0.20 per cent.

Any alkali liberated in water would be neutralized by the free fatty acids present so that the claim with reference to free lye is probably justified.

18474. *Soap.* Submitted for examination as to irritating action upon the skin. Only a trace of free alkali was found but alkaline salts (carbonates; etc.), were present in amount greater than most standards allow for laundry soap[1] and in too large an amount for toilet soap.

21787. *Soap,* Rinso. Submitted for identification of the alkali used. Tests indicated the sample to be a soda soap.

20705. *White Tablets.* Medicament, if any, was unidentified.

BABCOCK GLASSWARE.

Section 4788 of the General Statutes provides that all test bottles and pipettes, used in testing milk and cream which are to be paid for on the basis of the Babcock test, shall be tested and, if found accurate, stamped by this Station.

The following classification shows the number and distribution of pieces of such glassware examined by the Station during the past year.

Babcock Glassware Examined.

	Total	Broken	Accurate	Inaccurate
Cream test bottles.	636	9	614	13
Milk test bottles...........	3379	9	3317	53
Pipettes..................	470	4	465	1
Acid measures..............	10	0	10	0
Totals.................	4495	22	4406	67

Attention of dairy officials, licensed testers and others concerned with the testing of milk and cream is directed to Bulletin No. 6, issued by the Dairy and Food Commissioner, in which the apparatus recognized as *standard* is described and specifications therefor given. These specifications are substantially the same as recognized and approved by the United States Bureau of Standards and also by the American Dairy Science Association and the Association of Official Agricultural Chemists. The types of test

[1] See Conn. Exp. Sta., Bull. 227, p. 267.

bottles regarded as *standard* are (1) *8 per cent. 18 gram milk test bottle*; (2) *50 per cent. 9 gram short neck cream test bottle*; (3) *50 per cent. 9 gram long neck cream test bottle*; and (4) *50 per cent. 18 gram long neck cream test bottle.* Frequently bottles of other descriptions are submitted for test of calibration. The Station does not feel justified under the Statute in refusing to certify such glassware, so long as it is for use in connection with the Babcock test, but it notifies the senders of non-standard types so that exchanges may be made if desired. These approved types adequately meet all ordinary requirements for the testing of milk and cream for milk fat and a multiplicity of styles and types serves no useful purpose.

BULLETIN 256 FEBRUARY, 1924

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

TWENTY-THIRD REPORT

OF THE

STATE ENTOMOLOGIST

OF

CONNECTICUT

1923

W. E. BRITTON, Ph.D.
State Entomologist

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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February, 1924

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The Wilson H. Lee Co.

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BULLETIN 256

TWENTY-THIRD REPORT

OF THE

State Entomologist of Connecticut.

To the Director and Board of Control of the Connecticut Agricultural Experiment Station.

I have the honor to transmit, herewith, my twenty-third annual report as State Entomologist of Connecticut. Except for the financial statements which cover the fiscal year ending June 30, 1923, this report relates the activities of the department for the calendar year of 1923. It contains the usual somewhat detailed account of work prescribed by the Statutes, such as nursery and apiary inspection, mosquito elimination and gipsy moth suppression. The account of the gipsy moth work is given in condensed form. The results of studies of the raspberry fruit worm by Mr. B. H. Walden, have already been published as Bulletin 251, and of the European red mite, by Dr. Philip Garman, as Bulletin 252 of this Station. Special papers in this report deal with the results of experiments in dusting *versus* spraying apple orchards in 1923, the European corn borer, Oriental peach moth, the Asiatic beetle, the larch case-bearer, further experience with paradichlorobenzene as a remedy for peach borers, tests of sodium hypochlorite for the control of American foul brood of bees, swarms of aphids, and notes on miscellaneous insects.

Respectfully submitted,

W. E. Britton,
State and Station Entomologist.

INSECT PEST ACCOUNT.

Report of Receipts and Expenditures of the State Entomologist.

From July 1, 1922 to June 30, 1923.

Receipts.

From E. H. Jenkins, Treasurer	$13,025.34	
Account of 1922, Balance	1,089.53	
State Comptroller, Gipsy Moth Account	218.80	
Interest on Bank Deposits	42.31	
Various Sources (automobile mileage)	49.02	
		$14,425.00

Expenditures.

For Salaries and Wages	$8,111.28	
Printing and Illustrations	363.13	
Postage	17.77	

Stationery	$ 211.51	
Furniture and Fixtures	127.95	
Library (Books and Periodicals)	1,011.93	
(Binding)	8.10	
Laboratory Supplies	692.38	
Spraying Supplies	105.00	
Machinery, Tools and Supplies	255.73	
Scientific Apparatus	593.16	
Express, Freight and Cartage	32.11	
Automobiles: Insurance	105.71	
Supplies and Equipment	175.88	
Repairs	218.72	
Gasoline	199.25	
Oil	64.05	
Traveling Expenses	267.07	
Miscellaneous	785.88	
Telephone and Telegraph	1.55	
Heat and Light	1.00	
Rental and Storage	42.85	
Balance, Cash on Hand	1,032.99	
		$14,425.00

Memorandum.—This account has been audited by the State Auditors of Public Accounts. The item of $218.80 received from the State Comptroller is in effect a transfer from the appropriation for suppressing gipsy and brown-tail moths and for inspecting imported nursery stock, and covers the time and automobile mileage of members of the department staff while engaged in the work of inspecting imported nursery stock. The item of $785.88 under miscellaneous expenditures includes interest on bank balances, automobile mileage and other miscellaneous receipts paid over to the Station Treasurer and by him returned to the State Comptroller.

Summary of Inspection and Office Work.

224 samples of insects received for identification.
114 nurseries inspected.
108 regular certificates granted.
85 duplicate certificates furnished to be filed in other States.
60 parcels of nursery stock inspected and certified.
31 orchards and gardens examined.
35 shipments, containing 179 cases, 1,981,895 plants, imported nursery stock inspected.
15 shipments or 42.8 per cent. found infested with insects or fungi.
725 apiaries, containing 6,802 colonies inspected.
17 apiaries and 25 colonies found infested with European foul brood.
7 apiaries and 22 colonies found infested with American foul brood.
2,283 letters written on official work.
663 circular letters.
368 post cards.
53 reports to Federal Horticultural Board.
857 bulletins, etc., mailed on request or to answer inquiries.
86 packages sent by mail or express.
19 lectures and addresses at institutes, granges and other meetings.

Publications of the Entomological Department, 1923.

By W. E. Britton:

Twenty-second Report of the State Entomologist of Connecticut (Bulletin 247) 118 pages, 8 figures, 16 plates; 10,500 copies distributed in October, 1923.

The Aleyrodidae and Coccidae of Connecticut. Reprinted from Bulletin No. 34, Connecticut Geological and Natural History Survey, 48 pages, 3 figures, 4 plates, June, 1923.

The European Corn Borer Quarantine, Bulletin of Immediate Information No. 25, 5 pages; 3,000 copies, June, 1923.

The Apple and Thorn Skeletonizer, Bulletin of Immediate Information No. 26, August 15, 1923.

Registration of Bees, Bulletin of Immediate Information No. 27, 200 copies, September 15, 1923.

The Apple and Thorn Skeletonizer, Proceedings 32nd Annual Meeting Connecticut Pomological Society, page 21, 1923.

Rapid Spread of the Apple and Thorn Skeletonizer, *Hemerophila pariana* Clerck, Journal of Economic Entomology, Vol. 16, page 207, April, 1923.

The Gipsy Moth, Proceedings of Conference at Albany, N. Y. November 16, 1922, Bulletin 148, New York State Department of Agriculture, page 44, December, 1922.

Swarms of Aphids, Journal of Economic Entomology, Vol. 16, page 395, August, 1923.

Report of Committee on Injurious Insects, Proceedings 32nd Annual Meeting, Connecticut Pomological Society, page 5, 1923.

The Arbor-Vitae Leaf-Miner, Tree Talk, Vol. 5, No. 2, page 24, 1923.

The Work of the State Entomologist, Hartford Daily Courant, Sunday, October 21, 1923.

Insects Attacking Vegetable Crops in 1922 (Insect Part of Report of Committee on Diseases and Insects), Report of Connecticut Vegetable Growers Association for 1922, page 83.

Recent Developments in the Use of Insecticides, Part II, Bulletin 242, page 163.

By W. E. Britton and G. P. Clinton:

Spray Calendar, (Bulletin 244) 44 pages with card, illustrated, 11,500 copies, May, 1923.

The Winter Pruning of Fruit Trees, Bulletin of Immediate Information, No. 19, March 14, 1923.

Dormant Sprays on Orchard Trees, Bulletin of Immediate Information No. 20, March 21, 1923.

The Pink Spray for Apple Orchards, Bulletin of Immediate Information No. 22, May 1, 1923.

The Calyx Spray for Apples and Quinces, Bulletin of Immediate Information No. 24, May 21, 1923.

By W. E. Britton et al: The Hemiptera of Connecticut, Bulletin No. 34, Connecticut Geological and Natural History Survey, Projected and Edited by W. E. Britton. Text by J. F. Abbott, A. C. Baker, H. G. Barber, W. E. Britton, W. T. Davis, D. M. DeLong, W. D. Funkhouser, H. H. Knight, A. C. Maxson, Herbert Osborn, H. M. Parshley, E. M. Patch, L. A. Stearns, J. R. de la Torre-Bueno, E. P. Van Duzee and H. F. Wilson; 807 pages, 169 figures, 20 plates, June, 1923.

By M. P. Zappe and E. M. Stoddard:

Results of Dusting *vs.* Spraying in Connecticut Apple and Peach Orchards in 1922 (Bulletin 245), 17 pages, June, 1922.

Comparative Results of Spraying and Dusting on Apples and Peaches, Proceedings 32nd Annual Meeting Connecticut Pomological Society, page 30, 1923.

By Philip Garman:

Work with the Control of the European Red Mite in 1922. Proceedings 32nd Annual Meeting, Connecticut Pomological Society, page 13, 1923.

Notes on the Life History of *Clastoptera obtusa* and *Lepyronia quadrangularis*, Annals Entomological Society of America, Vol. XVI, page 153; 10 pages, 1 figure, 1 plate, June 1923.

BY B. A. PORTER AND PHILIP GARMAN:
The Apple and Thorn Skeletonizer, Bulletin 246, 20 pages, 3 figures, 4 plates, June, 1923.

BY SAMUEL T. SEALY:
Recent Development of Mosquito Work in Connecticut, Proceedings of the Ninth Annual Meeting of the New Jersey Mosquito Extermination Association, page 94, 1922.
Accomplishments in the Past Year in Anti-Mosquito Work in Connecticut, Proceedings of the Tenth Annual Meeting of the New Jersey Mosquito Extermination Association, page 91, 1923.

DEPARTMENT STAFF AND WORK.

W. E. BRITTON, PH.D., *State and Station Entomologist.*
B. H. WALDEN, B.AGR., *Photographic and General Work.* } *Assistant Entomologists.*
M. P. ZAPPE, B.S., *Inspection and General Work.* } *Assistant Entomologists.*
PHILIP GARMAN, PH.D., *Research Work.* } *Assistant Entomologists.*
JOHN T. ASHWORTH, *Deputy in Charge of Gipsy Moth Work.*
JAMES A. MCEVOY, *Assistant in Gipsy Moth Work.*
SAMUEL T. SEALY,[1] } *Deputy in Charge of Mosquito Work.*
ROBERT C. BOTSFORD,[2] } *Deputy in Charge of Mosquito Work.*
MISS GLADYS M. FINLEY, *Clerk and Stenographer.*

H. W. COLEY, Westport, } *Apiary Inspectors.*
A. W. YATES, Hartford, } *Apiary Inspectors.*

Mr. Samuel T. Sealy, who has served as Deputy in charge of mosquito work for three years, resigned to take effect April 1, 1923. Mr. Walden was placed in charge of this work temporarily. Mr. Robert C. Botsford was employed to work with Mr. Walden and on becoming familiar with the situation was appointed Deputy July 1.

Mr. J. Leslie Rogers was employed from July 1 to December 1 to aid in inspecting nurseries and after that work was finished, to search for the European corn borer. Mr. T. F. Cronin was employed from June to September as assistant in inspection of nurseries. Mr. M. J. Hubbell was employed during November in the construction of the addition to the insectary and in building some out-door breeding cages.

Besides giving his attention to the mosquito control for three months, Mr. Walden was able to complete his studies on the raspberry fruit worm, the results of which have been published as Bulletin No. 251.

Dr. Garman has continued with experiments to control the European red mite, *Paratetranychus pilosus* Can. & Fanz., and his results of four seasons' work in Connecticut against this pest have been published as Bulletin 252. Dr. Garman has given considerable attention to a study of the mites, has worked with Mr. Zappe on the investigations of the plum curculio on apple and *Anomala*

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[1] Resigned April 1.
[2] From July 1.

orientalis, and has completed the manuscript of a monograph of the Odonata or Dragon Flies of Connecticut to be published in the near future by the State Geological and Natural History Survey.

Mr. Zappe has been in charge of the inspection of nursery stock, and of scouting for European corn borer. In co-operation with Mr. E. M. Stoddard of the Botanical Department, Mr. Zappe has continued the tests of various dusts in comparison with sprays in apple and peach orchards for the control of the various insects and fungous pests. The work this year was chiefly for the purpose of trying some of the new copper dusts, but in most cases insecticides were added and the results so far as they relate to insects may be found in the following pages of this report.

Dusts were also applied to potatoes at the Station Farm in comparison with the usual spray of Bordeaux mixture and lead arsenate. Mr. Zappe has further experimented with Paradichlorobenzene as an agent in controlling the peach borer.

The plum curculio, *Conotrachelus nenuphar* Hbst., has proven a serious pest of apples in Connecticut, often disfiguring a large proportion of the fruit and is seemingly difficult of control. In order to learn more of its habits and to devise some more effective control methods a five-year program has been adopted. Some progress has been made during the past season by Messrs. Zappe and Garman.

The gipsy moth control work has been continued as for the past few years, the field work being in charge of Deputy John T. Ashworth, aided by his Assistant, Mr. J. A. McEvoy. About twenty-five other men have been kept busy throughout the year in scouting for egg-masses and larvae, and in spraying during the latter half of May and June. This work is performed in co-operation with the Federal Bureau of Entomology.

The apiary inspection work has been done as in past years by Messrs. H. W. Coley and A. W. Yates on a *per diem* basis.

The Entomologist, besides directing the work of the Department and attending to the correspondence of the office, has continued to serve as Associate Editor of the Journal of Economic Entomology, and as Chairman of the Tree Protection Examining Board. He has also continued to aid the Federal Bureau of Entomology by gathering data and submitting reports for the Insect Pest Survey. Several years ago he organized and projected the work on the Hemiptera of Connecticut, which has just been published as Bulletin No. 34 of the State Geological and Natural History Survey; he is the author of that portion dealing with the white flies (*Aleyrodidae*) and scale insects (*Coccidae*) and has edited the entire volume of 807 pages. Some of the drawings for the text figures were done by Dr. Garman and the photographs were arranged and most of them made by Mr. Walden. The index and much of the proof reading was done in this office and altogether considerable attention has been given to it during the year.

New Equipment.

During the year the equipment of the Department has been substantially increased. A new insectary 10 x 20 feet with boarded roof and sides covered with cottage wire netting has been built at the Station Farm at Mount Carmel, and has already been used in connection with the plum curculio investigations on apple. The out-door insectary at the Station, which was 10 x 16 feet in size with shingled roof has been moved about one hundred feet northward, and an addition 12 x 14 feet built, with glass roof and sides covered with chicken wire netting. The original portion has the sides covered with fine mesh copper wire, and will be kept as a separate compartment. Both insectaries are shown on Plate IX.

Two new binocular microscopes (one of portable type) and a Bausch & Lomb photomicrographic stand with accessory lens and lighting equipment, and a Wales adding machine have been purchased for the laboratory. A new self-recording thermometer was also obtained to use in the insectary.

Several important additions have been made to the library, including the insect portion of the Biologia Centrali-Americana and a complete set of the Bulletin of Entomological Research of England.

ENTOMOLOGICAL FEATURES OF 1923.

The season has been abnormal and quite the opposite of 1922, in that little rain fell between July 1 and October 1. Many crops were below the usual yield on account of the drought. Particularly were apples under size. The first of the season was cool and moist and there were several hard frosts in April, but no early hard frosts in the fall.

Perhaps the most outstanding features of the season, so far as insects are concerned, were the general injury of apple trees in July by the apple and thorn skeletonizer, *Hemerophila pariana* Clerck, which caused nearly all unsprayed apple trees throughout the central part of the State to turn brown, the increase in the Oriental peach moth, *Laspeyresia molesta* Busck, and the discovery of the European corn borer, *Pyrausta nubilalis* Hubn., in Groton in October and in East Lyme in December.

There has been no important increase in the territory infested by the gipsy moth as was the case in 1921, caused by wind-spread, though a few additional towns were found by Federal scouts to be infested. For this reason the towns of Goshen, Litchfield, Cheshire, Meriden, Middlefield, Wallingford, Old Lyme and Old Saybrook have been placed under Federal quarantine.

The brown-tail moth has not again appeared in Connecticut, and not a single nest has been seen since 1919.

FRUIT INSECTS.

The pear psylla, *Psylla pyricola* Forst., caused the usual amount of damage and was particularly prominent in a pear orchard in Southington in July.

The San José scale, *Aspidiotus perniciosus* Comst., is somewhat on the increase, though no such serious injury has been seen in Connecticut as has been reported from southern Illinois and Indiana.

The false apple red bug, *Lygidea mendax* Reut., was not prominent and generally caused less injury throughout the State than usual.

The pear leaf blister mite, *Eriophyes pyri* Pagst., was received from Hamden and Waterbury.

The European red mite, *Paratetranychus pilosus* Can. & Fanz., was responsible for rather wide-spread damage to Baldwin apple orchards during the season, probably more than in 1922. The results of Dr. Garman's experiments for the control of this pest may be found in Bulletin 252.

The rosy apple aphid, *Anuraphis roseus* Baker, caused less damage than usual though some injury was reported from Haddam and Deep River. Eggs were rather abundant on the fruit spurs in March about New Haven.

The green apple aphid, *Aphis pomi* DeGeer, was present on water-sprouts and terminal shoots, in usual abundance.

The rose leafhopper, *Empoa rosae* Linn., seemed to be more abundant than usual on apple trees, and on May 8, nymphs had just hatched from eggs at Milford.

The rose chafer, *Macrodactylus subspinosus* Fabr., was scarce in some localities and abundant in others and injured the developing fruit by eating holes in it.

The tarnished plant bug, *Lygus pratensis* Linn., caused some injury to the terminal twigs of apple and peach nursery stock and its work was observed in several nurseries in different parts of the State early in August.

The tent caterpillar, *Malacosoma americana* Fabr., is still increasing and may be expected to be very abundant throughout the State in 1924. Eggs are now present everywhere on the twigs of apple and wild cherry. During the year specimens of this insect were received from Clinton, Southport and Washington, with special reports from Danbury, Meriden and Mansfield, and from Fairfield, Litchfield and Windham Counties.

The apple maggot or railroad worm, *Rhagoletis pomonella* Walsh, was fully as abundant as usual though in our experiments, apples sprayed or dusted with lead arsenate after July 1 were almost free from injury. Specimens were received from New Haven, Cheshire and Berlin.

The plum curculio, *Conotrachelus nenuphar* Hbst., was more

abundant than in the average season and caused much injury to apples.

The Oriental peach moth, *Laspeyresia molesta* Busck, was more abundant than it has ever been before in Connecticut. The larvae tunneled in the twigs of peach trees, and were found in the fruit late in the season. This insect was first found in Connecticut at Stamford by Federal scouts in 1918, and it is not known to occur anywhere in the State except in Fairfield and New Haven Counties. In 1923 a few infested peaches were found at the Station Farm at Mount Carmel.

A cocoon of the bag worm, *Thyridopteryx ephemeraeformis* Haw., on quince was received from New Haven, May 1. The eggs hatched and the larvae were fed and reared to maturity and the adults obtained.

The grape vine tomato gall, *Lasioptera vitis* O. S., was abundant as usual, and specimens were received from West Hartford, June 14, and from New Britain, June 19.

The red-humped caterpillar, *Schizura concinna* S. & A., was present in usual numbers, and specimens were received from Bloomfield, July 16, and from East Hampton, August 14.

Vegetable Insects.

On account of the cool and damp weather in May and June the seed did not germinate promptly and there was considerable injury by the seed corn maggot, *Hylemyia cilicrura* Rond. One field of corn in Milford was seriously injured in June.

Wireworms (Elateridae) caused damage of varying extent in three fields of corn on one farm in Woodbridge, visited on July 6. In one small field 50 per cent. of the corn had been destroyed.

Cutworms caused the usual amount of injury throughout the State, but serious injury to tobacco plants was reported from Portland, June 22, where there was 15 per cent. damage. The owner used poisoned bran mash, but also poisoned the plants and practiced hand-picking.

There was, perhaps, more than the usual amount of injury from the stalk borer, *Papaipema nitela* Guen. Records of injury to corn came from Somers, Torrington, Waterbury, Hamden and Derby. In Windsor it attacked tobacco, and in Stratford, tomatoes and peppers. This insect occurs over the entire State, and may tunnel in any kind of herbaceous stem—even weeds. No remedy is known other than destroying the borers when found.

The corn ear worm, *Chloridea obsoleta* Fabr., was present in a number of fields late in the season, as it was in 1922, but was nowhere nearly so abundant as in 1921.

The turnip aphid, *Aphis pseudobrassicae* Davis, killed or seriously injured turnips and kale in many parts of the State in June, July and August. Specimens were received from Meriden, Danbury, Harwinton, Hamden and New Haven.

Colonies of the cabbage aphid, *Brevicoryne brassicae* Linn., started on cabbages in New Haven and did some damage, but later disappeared.

The pea aphid, *Illinoia pisi* Kalt., was also present on garden peas and caused perhaps the usual amount of damage. This damage was serious in some fields, one grower near New Haven reporting a total loss on three acres. In certain parts of Hartford County, a forty per cent. infestation was observed on June 22, and reported by County Agent Southwick.

The potato aphid, *Macrosiphum solanifolii* Ashm., also appeared in many fields and caused considerable injury. Samples were received from Wallingford on July 30, with the tips badly infested. At the Station Farm, Mount Carmel, a potato field was moderately infested, though the bulk of the aphids came later in the season than usual. They were abundant on August 7, but by August 24 had all disappeared.

The squash vine borer, *Mellitia satyriniformis* Hubn., the squash bug, *Anasa tristis* DeGeer, and the striped cucumber beetle, *Diabrotica vittata* Fabr., were all present in usual numbers, the last being reported as being very abundant at Storrs on June 22.

Considerable injury resulted from the attacks of the potato or cucumber flea beetle, *Epitrix cucumeris* Harr., and four per cent. damage in Woodstock on June 19, was reported by County Agent Davis.

In September, tobacco fields were severely injured by having the leaves partially eaten by the red-legged grasshopper or locust, *Melanoplus femur-rubrum* DeGeer. This damage was estimated as amounting to between forty and sixty per cent.

The brown colaspis, *Colaspis brunnea* Fabr., caused some injury in Hamden and Durham by feeding upon the leaves of beans. The observations were made by Mr. Zappe.

The European corn borer, *Pyrausta nubilalis* Hubn., was discovered at Groton by Federal scouts on October 25, 1923, and a few days later another small infestation was found farther eastward in the same town. All corn stalks, weeds, grass and rubbish on these small fields was burned. On December 14, another small infestation was found by Federal scouts in the village of Niantic, township of East Lyme. These infestations are described more in detail on page 278.

The Asiatic beetle, *Anomala orientalis* Waterhouse, which was discussed in last year's Report, pages 277 and 345, has caused considerable damage to lawns in the vicinity where the adult beetles were first discovered. The larvae eat the roots of the grass, killing it. A more complete account of this introduced pest will be found in the following pages of this Report.

White grubs devouring the grass roots of a lawn in Salisbury were sent by the owner to the Bureau of Entomology at Washington, and identified by Dr. Boving as *Anomala marginata* Fabr.

This is a species occurring in the southern Atlantic States and was not known to be present in Connecticut. Mr. Zappe visited the place and gathered material on September 25, and an attempt will be made to rear the adults.

Shade Tree and Forest Insects.

The woolly maple leaf scale, *Phenacoccus acericola* King, continues to infest sugar maple trees in villages and cities, but has not been observed in abundance on maple trees in the open country. Specimens were received from New Haven, Thompsonville and Norwalk.

The oyster-shell scale, *Lepidosaphes ulmi* Linn., is without doubt the commonest scale insect in Connecticut, and infests not only shade and forest trees but also fruit trees and ornamental shrubs. It is the commonest insect found by inspectors in nurseries, and though perhaps not more abundant than usual, it seems to be fairly abundant year in and year out. As a rule, the growers pay little attention to it, except to destroy infested stock in nurseries when directed to do so.

The arbor-vitae leaf-miner, *Argyresthia thuiella* Pack., which caused considerable injury to arbor-vitae trees and hedges around New Haven in 1921 and much less in 1922, was not injurious in that region in 1923, though it was reported as causing serious damage to trees in New Canaan and Stamford.

The white pine weevil, *Pissodes strobi* Pk., still continues to injure small trees in the open with marked regularity. Specimens were received from Southington, Kensington and Windsor.

The imported pine sawfly, *Diprion simile* Hartig, is present here and there but not in great abundance. Specimens were received twice from New Haven during the season, and the insect was reported from Deep River.

The elm leaf beetle, *Galerucella luteola* Müll., caused more injury than last year throughout the State, but it was particularly severe in Fairfield County, and its work was observed in Glastonbury and Wethersfield.

The imported poplar and willow beetle, *Plagiodera versicolora* Laich., which first appeared in the State in Greenwich and Stamford has spread eastward and is now found in New Haven and Yalesville. Some of the infested trees in Greenwich were entirely defoliated.

The oak leaf-roller, *Tortrix quercifoliana* Fitch, was prevalent particularly around Hartford and Stamford on pin oaks. Certain trees in the vicinity of Stamford were nearly defoliated.

The larch leaf-miner, *Coleophora laricella* Hubn., was prevalent in some parts of the State and nearly defoliated the larch trees in June. Specimens were received from Canaan and New Canaan and the work of this insect was observed elsewhere.

The spruce leaf-miner, *Recurvaria piceaella* Kearfott, was received on May 7 from New Canaan, where it was causing some injury.

The larch leaf aphid, *Chermes strobilobius* Kalt., was present on larch leaves, especially of the European species. Specimens were received from New Canaan, June 7, and the writer observed this insect in New Haven.

The pine leaf scale, *Chionaspis pinifoliae* Fitch, continues to infest the leaves of several species of pines in sheltered situations. It was received from Manchester, August 22.

The beech leaf aphid, *Phyllaphis fagi* Linn., is nearly always present on the leaves of the European beech, especially the purple leaved form known as the copper beech. Specimens were received from Danbury, May 29.

Two periods of aphid swarming occurred in the cities of the State, one in June and the other in September. The June swarms consisted of *Euceraphis deducta* Baker, and the September swarms were *Aphis betulaecolens* Fitch. Both species infest birch trees and no doubt they came from the gray birches which grow abundantly in most parts of the State. They are certainly common near New Haven, Bridgeport and Waterbury where these swarms were particularly noticeable.

Late in the season willow trees throughout the State were infested with brown aphids, *Melanoxantherium* sp. Mr. Zappe observed them especially in New Canaan, Darien, Woodmont, Yalesville, Cromwell and Manchester, while inspecting nurseries, and the writer saw them on a large willow tree in New Haven on August 30. The twigs were covered with large brown wingless aphids, and thousands of such aphids were crawling about on the fence, porch posts and rails and on the painted woodwork of the house. Wherever an aphid was crushed there was a purple stain, and these aphids in such abundance were a perfect nuisance. Honey dew had dripped from the branches upon the grass and fence underneath and both the tree and the ground were fairly swarming with bees, wasps and flies, attracted by the honey dew. The owner was advised to spray his tree and house with nicotine solution and soap to kill the aphids.

A woolly aphid, *Prociphilus tessellata* Fitch, on maple, was received from Torrington, July 30.

The walnut caterpillar, *Datana integerrima* G. & R., was reported as being common at Chester in early fall.

The European pine shoot moth, *Evetria buoliana* Schiff, was received from Tarrytown, N. Y., on October 3, and from Ridgefield on November 24. This insect had attacked the Norway or red pine and its shoots were crooked and deformed as is characteristic of the injury caused by this insect.

The birch leaf skeletonizer, *Bucculatrix canadensisella* Chamb., was fully as abundant as in 1922 and defoliated birch trees here

and there throughout the State. Many thought it to be the same insect which skeletonized the apple trees.

The fall canker-worm, *Alsophila pometaria* Harr., was rather abundant in some localities and the larvae fed upon the leaves of shade, forest and fruit trees. Around Saybrook and New Haven, this injury was rather prominent, and apple, elm, poplar, birch and walnut (*Juglans*) leaves were eaten. During November and December the gray male moths were unusually common, fluttering about the base of trees, and we may expect considerable injury from this insect next season. The females have no wings and must crawl up the trunks of trees to lay their eggs. Only early spraying with some arsenical poison will prevent damage next season.

The fall web-worm, *Hyphantria cunea* Drury, which makes nests on the ends of branches the latter part of the season was also especially prominent in Hartford, Tolland, Windham and New London Counties. Specimens were sent in from East Granby, Meriden and Plantsville. Roadside, woodland and fruit trees were attacked and many were entirely defoliated.

Miscellaneous Insects.

The house centipede, *Scutigera forceps* Raf., was sent to the office October 2 from Southport, where it annoyed the inmates of a dwelling house.

The basement of an apartment house in New Haven became overrun by the European cricket, *Gryllus domesticus* Linn., and both owner and tenant applied to the writer in April for advice.

The black carpet beetle, *Attagenus piceus* Oliv., causes considerable damage each year by eating holes in clothing hanging in closets. During the season specimens were received from Meriden and Farmington. If small pieces of wool cloth are kept on the floor, the larvae will often feed upon them instead of attacking the clothing.

The chrysanthemum gall midge, *Diarthronomyia hypogaea* Loew., was sent to the Station, April 10 from some commercial greenhouses at Rowayton where the small potted plants had galls on the leaves.

A small leaf beetle, *Nodonota puncticollis* Say, was reported as eating the buds of roses in Bridgeport, June 19, and specimens were sent to the office.

The Euonymus scale, *Chionaspis euonymi* Comst., was received from New Haven on April 3 on *Pachysandra terminalis*, a low-growing evergreen plant used in shady situations by landscape gardeners. This is the first time that I have ever seen this plant infested.

The four-lined leaf bug, *Poecilocapsus lineatus* Fabr., was common in 1923 and attacked the growing tips of many different

kinds of plants. Specimens were received on currant from Hamden, June 23, on currant and chrysanthemum from West Haven June 26, and on peony and spearmint from Stratford, July 2.

The rhododendron borer, *Sesia rhododendri* Beut., described in the Report of this Station for 1922, page 347, is still causing injury in rhododendron plantations and the growers are interested in methods of controlling it. Specimens were received from Yalesville, June 16 and from Springfield, Mass., June 28.

Geranium plants were received from New Haven, August 3 which had been injured by white ants, *Reculitermes flavipes* Kollar. The ants had tunneled in the stems ruining some of the plants.

On November 23, specimens of box twigs were received from Waterford. The leaves were badly infested with larvae of the box leaf-miner, *Monarthropalpus buxi* Labou. If possible some experiments will be conducted for the control of this pest.

Larkspur plants on the grounds of Miss A. B. Jennings, Fairfield, were severely injured by the mite, *Tarsonemus pallidus* Banks. Dr. Garman visited the place on July 3 and found that many of the buds had been deformed and had turned black and some leaves were deformed.

The more important of these insects mentioned above, together with accounts of the experimental and control work of the Department are described in greater detail in the following pages of this Report.

Summer Field Meeting.

An important entomological event of the season was the summer field meeting of the entomologists of the northeastern United States, which was held in Connecticut July 26 and 27. The members gathered in New Haven on the afternoon and evening of July 25, the Hotel Taft being the headquarters. The trips to various points were made by automobile. On the morning of the 26th, they visited the Entomological Department of this Station and the Station Farm at Mount Carmel, then West Rock Park, Yale Bowl, Harkness Memorial Quadrangle, and the orchard of Frank N. Platt, Milford, where spraying and dusting experiments were being conducted. From this point the party proceeded along the coast to the State Park at Hammonasset Beach, Madison. Following the luncheon, there was a baseball game (Worthley, umpire); some of the entomologists went bathing while others collected insects along the beach. Late in the afternoon, the party went northward, passing Wesleyan University at Middletown, stopping at the large greenhouse and nursery establishment of the A. N. Pierson Co., Cromwell, viewed the gigantic elm tree in Wethersfield, and then to Hartford, where at the Hotel Bond a dinner and evening meeting had been arranged.

An interesting lecture on the Japanese beetle, illustrated by lantern slides, was given by Mr. Loren B. Smith of Riverton, N. J., in place of Mr. C. H. Hadley, who could not be present. Friday morning the party drove through Keney Park to the tobacco sub-station at Windsor, and visited the forest experimental plots at Rainbow, returning via Elizabeth Park, to Hartford, where luncheon was served in the State Capitol. After luncheon the visitors were shown about the Capitol and the State Library, then drove, via Rockville, to the Connecticut Agricultural College at Storrs. Here a demonstration of high-power spraying of woodland and orchard trees was given by the gipsy moth forces. After supper there was a baseball game between the Connecticut gipsy moth men and a team picked from the visitors (Burgess, umpire). In the evening motion pictures were shown in the armory, including those on the European corn borer, and the gipsy moth, prepared by the U. S. Department of Agriculture.

Besides members of the Station Staff, the following were present: H. A. Ames, Somerville, N. J.; E. A. Back, Washington, D. C.; D. N. Borodin, New York, N. Y.; H. L. Blaisdell, Melrose, Mass.; F. E. Brooks, Washington, D. C.; A. F. Burgess, Melrose Highlands, Mass.; C. W. Collins, Melrose Highlands, Mass.; C. R. Crosby, Ithaca, N. Y.; S. M. Dohanian, Somerville, Mass.; E. P. Felt, Albany, N. Y.; Hugh Glasgow, Geneva, N. Y.; F. W. Graves, Melrose Highlands, Mass.; Melvin Guptill, Sudbury, Mass.; T. L. Guyton, Harrisburg, Pa.; E. A. Hartley, Melrose Highlands, Mass.; G. W. Herrick, Ithaca, N. Y.; T. J. Headlee, New Brunswick, N. J.; H. E. Hodgkiss, State College, Pa.; C. E. Hood, Melrose Highlands, Mass.; J. L. Horsfall, Bustleton, Pa.; J. F. Jamieson, Riverton, N. J.; R. W. Kelley, New York, N. Y.; G. H. Lamson, Storrs, Conn.; F. H. Lathrop, Highland, N. Y.; M. D. Leonard, Albany, N. Y.; Q. S. Lowry, Boston, Mass.; J. A. Manter, Storrs, Conn.; C. W. Minott, Melrose Highlands, Mass.; F. H. Mosher, Melrose Highlands, Mass.; H. L. McIntyre, Albany, N. Y.; A. H. Parkins, Boston, Mass.; Alvah Peterson, New Brunswick, N. J.; D. M. Rogers, Boston, Mass.; J. V. Schaffner, Melrose Highlands, Mass.; A. F. Schulze, Storrs, Conn.; R. A. Sheals, Providence, R. I.; L. B. Smith, Riverton, N. J.; A. E. Stene, Kingston, R. I.; W. R. Walton, Washington, D. C.; H. I. Winchester, Melrose, Mass.; R. Woolridge, Melrose Highlands, Mass., and L. H. Worthley, Arlington, Mass.

INSPECTION OF NURSERIES IN 1923.

The General Statutes provide that "all nurseries or places where nursery stock is grown, sold, or offered for sale, shall be inspected at least once each year by the State Entomologist or one of his deputies, and if no serious pests are found, a certificate to that effect may be given." Consequently such inspection has been made each year of all growing nursery stock so far as the existence of such nursery stock is known to the State Entomologist. In 1923, two nurseries were inspected in the spring and again late in the summer. The annual inspection was commenced on July 26 and finished on September 26, except for one nursery learned about later and inspected on October 11. This work was in charge of Mr. M. P. Zappe, who was assisted by J. Leslie Rogers and T. F. Cronin. Mr. E. M. Stoddard of the Botanical Department and Doctors Garman and Britton helped one day each. For the most part these nurseries were given a rather more rigid inspection than usual, for, on account of the wide-spread infestations of the gipsy moth, it seemed almost necessary to make sure that none of the nursery stock was infested with that destructive pest. The weather was extremely favorable and as the whole period was one of protracted drought the work was not delayed on account of rain.

On the whole the nurseries were in good condition and fairly clean. Some owners are always more careful than others about such matters. Where the stock is kept clean it is not only easier to inspect, but the amount of stock to be treated or destroyed after inspection is reduced to a minimum.

At a hearing and conference before the Federal Horticultural Board at the State House, Boston, Mass., August 17, 1923, the point was made by the Board and confirmed by several of the nurserymen present that the nurseries must be kept comparatively free from serious insect and fungous pests. This idea should be reiterated and emphasized again and again. Clean stock only should be sent out from nurseries, and the customer has a right to expect it. Quarantine and inspection officers in other states are watching and may cause the destruction, treatment or return of stock found infested. Moreover, a large number of infested shipments from one state into another may lead to regulations prohibiting shipments altogether.

The understanding reached at the Boston conference is to the effect that a nurseryman must hold a state certificate before the Federal gipsy moth inspection will be granted. In the quarantined area this inspection and certification are necessary if one wishes to ship out of the infested area; but if the owner is not willing to clean up sufficiently to enable him to obtain a state certificate, the Federal inspection will be refused. Hence it behooves all nurserymen to co-operate cordially, promptly and thoroughly with the state inspectors, otherwise they may not be able to do

business because of these conditions. Several Massachusetts nurserymen stated that every tree and shrub in their nursery had been sprayed thoroughly with arsenate of lead.

However, there are pests other than the gipsy moth which must receive attention from the nurseryman. For instance the oyster-shell scale, *Lepidosaphes ulmi* Linn., is the commonest insect pest found in the nurseries, and the spruce gall aphid, *Chermes abietis* Linn., and the poplar canker, *Dothichiza populea*, are also close seconds. Both of these insects may be readily held in check by contact sprays made at the right time. The former has only one generation and the latter two generations each year in Connecticut. The spruce gall aphid attacks only spruce trees, but the oyster-shell scale infests a large number of different kinds of trees and shrubs.

Oyster-Shell Scale.

The oyster-shell scale lives through the winter in the form of white oval eggs which are formed under the shells during September. These eggs do not hatch until about the last week of the following May. The young then crawl out from underneath the old female shells and establish themselves on the bark. They soon begin to suck the sap and do not move afterwards. Each forms a shell, but these shells are very thin at first and gradually become larger and thicker. The proper time for the most effective treatment is soon after the eggs hatch and before the shells become heavy enough to protect the insects from the application. Thus a thorough spraying about the first week of June with kerosene soap emulsion, or with nicotine solution and soap will kill nearly all of the young scales. It is always advisable to cut and burn all branches or stems which can be spared and which are badly infested. The oyster-shell scale is particularly prevalent on willow, poplar, ash, birch, black walnut, butternut, lilac, maple and apple, and often occurs on many other trees and shrubs.

Spruce Gall Aphid.

The spruce gall aphid occurs only on spruce trees and two species may be found in Connecticut nurseries. The more common one, *Chermes abietis* Linn., attacks Norway, black, red and white spruces, and sometimes hemlock, making a cone-shaped swelling or gall at the base of the new growth. On the Colorado blue spruce, much larger galls occur which are caused by another species, *Chermes cooleyi* Gillette. The young females live on the twigs through the winter and in spring mature, lay their eggs and die. On hatching from the eggs in May, the young crawl to the tips of the twigs and settle at the base of the leaves where the

new growth is just beginning to form. The cone-shaped gall is here developed, the young being inside and sucking the sap. Becoming mature in August, the nymphs excape from the galls, which later turn brown and die, often killing the shoot beyond the gall. The insects molt after emerging and are then provided with wings. They crawl over the leaves where the females lay stalked eggs which hatch in about two weeks and this generation is the one which lives over winter on the twigs in a partially developed state.

On small trees in the nursery the galls may easily be clipped off in June and burned. This treatment has already been practiced in one Connecticut nursery where many conifers are grown, and resulted in few galls being found at the time of the annual inspection in August.

Spraying in April with a contact spray to kill the over-wintering females is one of the best control methods. In Massachusetts, whale oil soap, one pound in two gallons of water, proved so effective that no insects could be found afterward upon the trees. For several years in one large nursery the spruce trees have been sprayed in April with miscible oil, one part in twenty parts of water. The same treatment has also been applied late in the fall, and both spring and fall applications have been effective in controlling the spruce gall aphid. There has never been any injury to the trees from the treatment except once, and this was probably due to not mixing the contents of the original package thoroughly before diluting with water.

Poplar Canker.

From our records it appears that poplar canker was first found in Connecticut nurseries in 1918, when six nurseries were infested. Though each year infested trees have been destroyed, it has increased in abundance until in 1923 it occurred in 34 nurseries. This is an infectious disease caused by a fungus which grows in the bark in a manner similar to that of the chestnut blight, forming cankers and often girdling branches or the main trunk and killing all tissues above or beyond the point of attack. In nurseries, cutting and burning the diseased trees or branches is the remedy.

Pests Found in Nurseries.

In 32 nurseries no important pests were found. These were mostly newly established nurseries where the young stock has not become infested or small nurseries where special stock not commonly infested is grown. Following is a list of the principal pests found with the number of nurseries infested by each:

List of Pests Found in Nurseries in 1923.

INSECTS.

Aphids, apple, green	15
woolly	4
on chestnut	1
pine	1
spiraea	1
spruce gall, *Chermes abietis*	28
cooleyi	9
Apple and thorn skeletonizer	18
Arbor-vitae leaf-miner	1
Birch Bucculatrix	6
Borer, lilac	1
peach	1
poplar	2
Curculio, poplar	1
Lace bugs	2
Laspeyresia molesta	2
Lina scripta	1
Mite, European red	4
on box elder	1
Sawfly, *Diprion simile*	2
on arbor-vitae	1
willow	1
Scale, elm	10
Euonymus	2
Lecanium corni	1
oak gall scale (*Kermes*)	1
oyster-shell	42
pine leaf	8
rose	12
San José	20
scurfy	5
tulip tree	4
West Indian peach	1
white elm	1
Tarnished plant bug	1
White pine weevil	17

PLANT DISEASES.

Apple scab	3
Blister rust	6
Cedar rust	8
Crown gall	3
Fire blight	3
Mildew on rose	4
Mosaic, raspberry	4
Poplar canker	34
Uninfested	32

From the preceding list it may be seen that the oyster-shell scale is found in a larger number of nurseries (42) than any other pest on the list, though the poplar canker comes next, being found in 34 nurseries.

In order to show how the figures of 1923 compare with those of preceding years, the following table shows the comparative abundance of the principal nursery pests for the past six years:

Six Year Record of Serious and Common Nursery Pests.

Pest	1918	1919	1920	1921	1922	1923
Oyster-shell scale	39	38	38	36	44	42
San José scale	18	19	11	28	19	20
Spruce gall aphid	15	19	21	31	21	28
White pine weevil	5	5	1	1	19	17
Apple and thorn skeletonizer	..	..	..	..	1	18
Poplar canker	6	5	13	21	31	34
Blister rust	1	..	..	2	9	6
No pests	32	32	46	36	36	32

One nursery has gone out of business since last year, three have changed ownership, and fourteen new names appear on the list. One nursery has been inspected twice. The list contains five more names than the list for 1922. Six other nurseries were

inspected but have not reported that the infestations have been removed. These have no certificates and will violate the law every time they make a sale.

In addition to the inspection of the nurseries, 60 separate packages of nursery stock have been inspected to accommodate individuals who wish to ship, and in some cases inspection of parcels has been made and certificates issued to nurseries which have not received the regular form of certificate covering their nursery stock.

The nurserymen's list for 1923 contains 106 names, as follows:

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1923.

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Barnes Bros. Nursery Co.	Yalesville	150	Sept. 25	1421
Barnes Nursery & Orchard Co.	Wallingford	45	Oct. 8	1437
Barton Nursery	Hamden	1	Sept. 21	1411
Beattie, Wm. H.	New Haven	1	Sept. 21	1412
Benbow, A.	Norfolk	1	Oct. 1	1430
Bertolf Brothers	Greenwich	25	Sept. 18	1402
Brainard Nursery & Seed Co.	Thompsonville	10	Sept. 27	1424
Braley & Co.	Burnside	1	Sept. 11	1390
Bretschneider, A.	Danielson	1	Sept. 18	1404
Bristol Nurseries, Inc.	Bristol	16	Oct. 15	1439
Burr & Co., C. R.	Manchester, Ellington and Durham	500	Aug. 1	1363
Burroughs, Thos. E.	Deep River	3	Sept. 14	1396
Chapman, C. B.	Groton	1	Sept. 24	1419
Chapman, C. E.	North Stonington	2	Sept. 27	1427
Clinton Nurseries (Warren Richards, Mgr.)	Clinton	1	Oct. 31	1452
Conine Nursery Co.	Stratford	50	Sept. 8	1387
Conn. Agricultural College (Prof. S. P. Hollister)	Storrs	1	Nov. 17	1460
Conn. Agr. Exp. Sta. (W. O. Filley, Forester)	New Haven	1	Sept. 18	1401
Crofut & Knapp Farm	Norwalk	20	Nov. 23	1462
Cross Highway Nurseries	Westport	6	Nov. 28	1464
Crouch, Alden	Mystic	1	Apr. 7	1361
Dallas, Inc., Alexander	Waterbury	1	Sept. 22	1414
Dawson's Nursery	Willimantic	2	Aug. 24	1369
Dowd, F. C.	Madison	1	Sept. 7	1386
Dunlap, Daniel S.	Cromwell	1	Aug. 30	1378
Edgewood Nursery, Vidal, Inc.	Stamford	5	Sept. 14	1398
Eldredge, Charles F. (2)	Niantic	1	Sept. 24	1417
Elm City Nursery Co., Woodmont Nurseries, Inc.	Woodmont and New Haven	155	Aug. 27	1373
Evergreen Nursery Co.	Wilton	5	Sept. 7	1384
Fairty, C. H.	New Canaan	1	Dec. 7	1466
Falcon's Flight Farms Nursery (B. Austin Cheney, Prop.)	Litchfield	1	Oct. 6	1436
Fraser, G. W.	Willimantic	1	Aug. 24	1370
Gardner's Nurseries	Rocky Hill	5	Nov. 13	1459
Geduldig's Greenhouses	Norwich	1	Sept. 14	1397

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Glenn Terrace Ornamental Nursery (James H. Everett, Prop.)	Mount Carmel	6	Nov. 30	1465
Heath & Co	Manchester	5	Aug. 1	1365
Hilliard, H. J.	Sound View	1	Sept. 24	1418
Hiti Nurseries (J. H. Bowditch, Prop)	Pomfret Center	9	Aug. 30	1374
Holcomb, Irving	Simsbury	1	Aug. 30	1379
Hoogendoorn, C.	Yalesville	1	Sept. 6	1383
Horan & Son, Jas.	Bridgeport	1	Oct. 15	1440
Houstons' Nurseries	Mansfield	4	Nov. 3	1455
Hoyt's Sons Co., Inc., The Stephen	New Canaan	300	Sept. 20	1406
Hunt & Co., W. W.	Hartford	10	Sept. 26	1423
Isselee, Charles	Darien	10	Nov. 24	1463
Jones, William	Norwalk	1	Aug. 30	1375
Kelly, James J.	New Canaan	1	Sept. 13	1394
Kellner, Herman H.	Danbury	1	Sept. 27	1425
Keso Nursery (J. J. Kelsey, Prop.)	Clinton	1	Sept. 10	1388
Ladd & Nichols	Greenwich	2	Sept. 24	1415
Laddin's Rock Nursery (Est. of W. L. Marks)	Stamford	5	Aug. 24	1372
Langenbach, F. J.	Norwich	1	Aug. 24	1368
Leghorn, John J.	Cromwell	1	Aug. 30	1376
Mallett Co., George A.	Bridgeport	1	Oct. 15	1441
Maplewood Nurseries (T. H. Peabody, Mgr.)	Norwich	1	Nov. 9	1457
Marigold Farm (H. Kelley, Prop.)	New Canaan	6	Nov. 21	1461
Meier, A. R.	West Hartford	1	Oct. 19	1446
Millane Tree Expert Co., The	Middletown	1	Nov. 12	1458
Myers, C. B.	Milford and Rowayton	6	Oct. 15	1443
New Haven Nurseries Co., The	New Haven	10	Sept. 15	1399
New Haven Park Commissioners (G. X. Amrhyn, Supt.)	New Haven	30	Aug. 24	1371
New London Cemetery Association (Ernest E. Rogers, Pres.)	New London	1	Oct. 29	1447
New London County Nurseries (W. J. Schoonman, Prop.)	New London	5	Oct. 15	1442
North-Eastern Forestry Co.	Cheshire	20	Aug. 20	1367
Oakland Nurseries	Manchester	5	Aug. 1	1364
Outpost Nurseries (L. D. Conley, Prop.)	Ridgefield	25	Sept. 12	1393
Ouwerkerk & Van der Stam	Yalesville	7	Sept. 6	1380
Park Gardens	Bridgeport	1	Sept. 20	1407
Park Hill Flower Shop	Manchester	1	Sept. 12	1392
Pequod Nursery Co.	Yalesville	15	Sept. 11	1389
Phelps, J. Wesson	Bolton	1	Oct. 29	1448
Phelps & V. T. Hammer Co., The J. W.	Branford	2	Oct. 29	1449
Pierson, A. N., Inc.	Cromwell	50	Aug. 30	1377
Polish Orphanage Farm (Rev. L. Bojnowski, Mgr.)	New Britain	1	Sept. 25	1420
Pomeroy, Edwin C.	Northville	1	Sept. 27	1426
Reck, Julius	Bridgeport	1	Oct. 31	1450
Rockfall Nursery Co. (P. Marotta, Prop.)	Rockfall	4	Aug. 1	1366
Ryther, O. E.	Norwich	6	Oct. 3	1434
Saxe & Floto	Waterbury	1	Sept. 18	1405
Scheepers, Inc., John	Sound Beach	6	Sept. 18	1403
Schleichert, J. L.	Bridgeport	1	Sept. 20	1408

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Scott, J. W.	Hartford	5	Nov. 6	145
Seely, C. H.	Darien	1	Oct. 1	143
Sierman, C. H.	Hartford	5	Oct. 10	143
South Wilton Nurseries	South Wilton	5	Sept. 7	138
Stamford Seed & Flower Co.	Stamford	1	Oct. 1	143
Steck, Charles A.	Newtown	3	Oct. 2	143
Steck, Jr., Charles A.	Bethel	1	Oct. 31	145
Steck, Mrs. Chas.	Bethel	1	Oct. 31	145
Stratfield Nursery Co.	Bridgeport	6	Dec. 17	146
Stratford Nursery Co. (C. A. Cooper, Prop.)	Stratford	1	Sept. 20	141
Stratford Rose Nurseries (John Barrow, Prop.)	Stratford	3	Sept. 20	140
Tanner's Nursery Co.	Manchester	1	Oct. 16	144
Upson, R. E.	Marion	1	Sept. 25	142
Vanderbrook & Son, Chas. L.	Manchester	5	Sept. 11	139
Van Wilgen & Co.	Branford	15	Sept. 6	138
Verkade's Nurseries	New London	8	Sept. 24	141
Vidbourne & Co., J.	Hartford	7	Sept. 28	142
Wallace Nursery	Wallingford	2	Sept. 6	138
Watrous, Arthur J.	Meriden	1	Sept. 18	140
Wild, Henry	Greenwich and Norwalk	16	Oct. 6	143
Wilson & Co., C. E.	Manchester	50	Sept. 14	139
Woodruff, C. V.	Orange	1	Sept. 21	141
Yale University Forest School	New Haven	1	Sept. 28	142
Young, Mrs. Nellie A.	Pine Orchard	1	Oct. 31	145
Zack Co., H. J.	Deep River	2	Oct. 16	144
Total acreage		1,731		

INSPECTION OF IMPORTED NURSERY STOCK.

The nursery stock entering Connecticut from foreign countries during 1923 consisted of 35 shipments, 179 cases, and 1,981,895 plants. This is a larger number of shipments and cases than last year, but a smaller number of plants. The following table shows the quantities of such nursery stock inspected at destination by State inspectors during the last four years:

Year	No. of Shipments	No. of Cases	No. of Plants
1920	17	87	814,491
1921	21	126	1,228,560
1922	30	159	1,997,595
1923	35	179	1,981,895

This stock consists of Manetti rose stock and fruit seedlings to be used for propagation,—budding and grafting. More than one-half, mostly rose stock, was consigned to one firm. The inspections were nearly all made by Mr. Zappe.

The time required to inspect this stock amounts to 264 hours, or 1.35 months of 26 working days of seven and one-half hours

each. The total cost of this work including time of men and traveling expenses amounted to $289.11.

The sources of this imported nursery stock for the year were as follows:

SOURCES OF IMPORTED NURSERY STOCK, 1922-1923.

Country	No. of Shipments	No. of Cases	No. of Plants
France	14	74	1,009,700
Holland	14	79	720,195
England	5	21	212,000
Italy	1	2	13,000
Unknown	1	3	27,000
	35	179	1,981,895

The following table shows the quantities of stock as inspected by months:

Month	No. of Shipments	No. of Cases	No. of Plants
November	2	5	58,240
December	4	25	251,500
January	13	69	796,000
February	8	40	459,555
March	7	29	312,600
April	1	11	104,000
	35	179	1,981,895

In addition to the stock inspected and reported above, there were eight shipments containing 40 cases and 415,800 plants which were reshipped to other states and not inspected in Connecticut.

There were nine shipments consisting of 16 cases of seeds which entered Connecticut but were not inspected here. One shipment of one case containing 5,000 apple seedlings was received which had already been inspected in New York, and consequently it was not reinspected.

Of the 35 shipments inspected, 15 or 42.8 per cent. were found infested with insects or other animals or plant diseases, some of which are well-known pests. For instance, if *Aporia crataegi* Linn. should become established in the United States, it would add another to the already large list of pests which feed upon the foliage of fruit trees and rosaceous plants. Details of these infested shipments are given below.

PESTS FOUND ON IMPORTED NURSERY STOCK.

15 Shipments Infested.

INSECTS.

Aporia crataegi Linn. on fruit seedlings. (1 shipment) A. Choplin, Maze, France.

Emphytus cinctus Linn. (13 shipments) Fa. As. Ouwerkerk, Boskoop, Holland; W. Fromow & Sons, Windlesham, Surrey, England; M. Gielen, Oudenbosch, Holland; B. Rugo, Ltd., Dedemsvaart, Holland; W. C.

Slocock, Woking, Surrey, England; P. L. Renault, Orleans, France; Hemeray-Aubert, Orleans, France; D. G. de Jonge, Sappemeer, Holland; Felix & Dykhuis, Boskoop, Holland; S. Bide & Sons, Ltd., Farnham, Surrey, England; N. Levasseur & Fils, Ussy, France.

Lepidopterous cocoons. (2 shipments) P. L. Renault, Orleans, France; N. Levasseur & Fils, Ussy, France.

Spider's eggs. (1 shipment) P. L. Renault, Orleans, France.

PLANT DISEASES.

Crown Gall on Manetti rose. (6 shipments) W. Fromow & Sons, Windlesham, Surrey, England; R. C. Noteutt, Woodbridge, England; W. C. Slocock, Woking, Surrey, England; Hemeray-Aubert, Orleans, France; S. Bide & Sons, Ltd., Farnham, Surrey, England.

INSPECTION OF APIARIES.

As in preceding years, the work of inspecting apiaries has been done on a *per diem* basis by Messrs. H. W. Coley of Westport and A. W. Yates of Hartford. Mr. Coley covers the southern half of the State, Fairfield, New Haven, Middlesex and New London Counties. Mr. Yates covers the northern half, Litchfield, Hartford, Tolland and Windham Counties.

This work required a total of 131 man days, and the entire cost for the season was $1,849.80.

Fewer apiaries were inspected in 1923 than in each of the three years preceding. This was due, in part at least, to the fear that bees would take to "robbing" if disturbed, on account of the extreme lack of moisture.

The following figures show the number of apiaries and colonies inspected, and the average number of colonies per apiary for the past three seasons:

Year	No. Apiaries	No. Colonies	Average No. Colonies per Apiary
1921	751	6,972	9.2
1922	797	8,007	10.04
1923	725	6,802	9.38

In 1923, inspections were made in 119 towns as against 125 towns in 1922. No apiaries have ever been inspected in the town of Union, Tolland County, because the inspector has never been able to learn of bees being kept in that town.

In 1923, inspections were made in the following 22 towns not visited in 1922: *Fairfield County:* Danbury, Stratford and Trumbull; *New Haven County:* Derby, Meriden and Orange; *Middlesex County:* Cromwell, East Haddam, East Hampton, Haddam, Middlefield and Middletown; *New London County:* None; *Litchfield County:* Bethlehem, Harwinton, New Hartford, Watertown and Woodbury; *Hartford County:* Farmington and Rocky Hill; *Tolland County:* None; *Windham County:* Chaplin, Eastford and Putnam.

On the other hand, in 1922 inspections were made in the following 29 towns not visited in 1923: *Fairfield County:* Bridgeport, Newtown and Weston; *New Haven County:* Bethany, East Haven, Middlebury, New Haven, Oxford and Woodbridge; *Middlesex County:* Westbrook; *New London County:* Colchester, Lyme and North Stonington; *Litchfield County:* Bridgewater, Canaan, Cornwall, Kent, New Milford, Norfolk, North Canaan, Salisbury and Sharon; *Hartford County:* Avon and Hartford; *Tolland County:* Tolland and Willington; *Windham County:* Ashford, Brooklyn and Scotland.

European Foul Brood.

Out of the 725 apiaries and 6,802 colonies inspected in 1923, 17 apiaries and 25 colonies were found infested with European foul brood. This gives a ratio of 2.34 per cent. of apiaries and .36 per cent. of colonies infested, as against 4.14 and .85 per cent. respectively in 1922.

European foul brood has gradually decreased in Connecticut since the inspection was begun in 1909. In 1923 this disease was not found at all in Fairfield, New Haven and Tolland Counties. European foul brood was found in the following towns in 1923: *Middlesex County:* Durham and East Hampton; *New London County:* Norwich, Old Lyme and Stonington; *Litchfield County:* Winchester; *Hartford County:* Glastonbury and Suffield; *Windham County:* Killingly, Plainfield, Pomfret, Putnam and Sterling.

Last year 33 apiaries and 68 colonies were found infested with European foul brood. Compared with these figures, the infestations in 17 apiaries and 25 colonies in 1923 are quite encouraging.

American Foul Brood.

Of the 725 apiaries and 6,802 colonies inspected in 1923, seven apiaries and 22 colonies were infested with American foul brood. This is a ratio of .965 per cent. of apiaries and .323 per cent. of colonies as against 1.38 and .27 per cent. respectively in 1922. American foul brood was not found in Connecticut until 1914. Since then there has never been much of this disease, but the percentage is spasmodic and erratic. It fluctuates irregularly and has shown no such gradual change as has been the case with the decrease in the European foul brood.

In 1923, this disease occurred in the following seven towns: *Fairfield County:* Greenwich and Trumbull; *New Haven County:* Derby, Seymour and Wallingford; *Middlesex County:* East Hampton; *Windham County:* Killingly.

The statistics of the apiaries inspected in each of the 119 towns visited, arranged by counties, are given on the following pages, and summarized on page 252.

APIARIES INSPECTED IN 1923.

	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased	American Foul Brood	European Foul Brood	Sacbrood
Fairfield County:							
Bethel	5	0	22	0	0	0	0
Danbury	1	0	15	0	0	0	0
Darien	1	0	16	0	0	0	0
Easton	6	0	120	0	0	0	0
Fairfield	9	1	83	2	0	0	2
Greenwich	7	4	27	7	6	0	1
Monroe	4	0	77	0	0	0	0
New Canaan	2	0	29	0	0	0	0
Norwalk	5	0	63	0	0	0	0
Redding	7	0	29	0	0	0	0
Shelton	2	0	34	0	0	0	0
Stamford	7	0	162	0	0	0	0
Stratford	6	0	37	0	0	0	0
Trumbull	8	1	100	2	2	0	0
Westport	6	0	56	0	0	0	0
Wilton	5	1	75	1	0	0	1
	81	7	945	12	8	0	4
New Haven County:							
Beacon Falls	2	0	38	0	0	0	0
Branford	2	0	10	0	0	0	0
Cheshire	3	0	47	0	0	0	0
Derby	4	1	33	6	6	0	0
Guilford	2	0	34	0	0	0	0
Hamden	5	0	57	0	0	0	0
Madison	2	0	24	0	0	0	0
Meriden	14	0	99	0	0	0	0
Milford	6	0	78	0	0	0	0
Naugatuck	7	0	52	0	0	0	0
North Haven	7	0	87	0	0	0	0
Orange	5	0	33	0	0	0	0
Prospect	5	0	79	0	0	0	0
Seymour	2	1	33	2	2	0	0
Wallingford	26	2	154	3	1	0	2
Waterbury	10	0	115	0	0	0	0
West Haven	1	0	7	0	0	0	0
	103	4	980	11	9	0	2
Middlesex County:							
Chester	7	0	44	0	0	0	0
Clinton	2	0	17	0	0	0	0
Cromwell	1	0	3	0	0	0	0
Durham	9	2	147	4	0	4	0
East Haddam	11	0	226	0	0	0	0
East Hampton	10	3	100	4	2	2	0
Essex	2	0	29	0	0	0	0
Haddam	8	0	74	0	0	0	0
Killingworth	2	0	11	0	0	0	0

APIARIES INSPECTED IN 1923—*Continued.*

	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased	American Foul Brood	European Foul Brood	Sacbrood
Middlesex County—*Con.*							
Middlefield	5	0	56	0	0	0	0
Middletown	1	0	1	0	0	0	0
Old Saybrook	3	0	58	0	0	0	0
Saybrook	5	0	24	0	0	0	0
	66	5	790	8	2	6	0
New London County:							
Bozrah	2	0	17	0	0	0	0
East Lyme	3	0	47	0	0	0	0
Franklin	3	0	35	0	0	0	0
Groton	3	0	23	0	0	0	0
Lebanon	4	0	44	0	0	0	0
Montville	3	0	36	0	0	0	0
New London	2	0	24	0	0	0	0
Norwich	7	1	566	1	0	1	0
Old Lyme	2	1	45	2	0	2	0
Preston	9	0	66	0	0	0	0
Stonington	4	1	23	1	0	1	0
Waterford	3	0	20	0	0	0	0
	45	3	946	4	0	4	0
Litchfield County:							
Barkhamsted	1	0	18	0	0	0	0
Bethlehem	1	0	8	0	0	0	0
Colebrook	2	0	9	0	0	0	0
Goshen	4	0	16	0	0	0	0
Harwinton	1	0	3	0	0	0	0
Litchfield	20	1*	175	1*	0	0	0
Morris	7	0	45	0	0	0	0
New Hartford	1	0	5	0	0	0	0
Plymouth	6	0	17	0	0	0	0
Thomaston	10	0	76	0	0	0	0
Torrington	6	0	54	0	0	0	0
Washington	2	1*	76	1*	0	0	0
Watertown	18	0	92	0	0	0	0
Winchester	10	2*	61	6*	0	5	0
Woodbury	5	1*	50	1*	0	0	0
	94	5*	705	9†	0	5	0
Hartford County:							
Berlin	17	0	199	0	0	0	0
Bloomfield	5	0	54	0	0	0	0
Bristol	15	0	74	0	0	0	0
Burlington	2	0	13	0	0	0	0
Canton	9	0	68	0	0	0	0
East Granby	6	0	32	0	0	0	0

* 1 colony with Paralysis.
† 4 colonies with Paralysis.

APIARIES INSPECTED IN 1923—*Continued.*

	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased	American Foul Brood	European Foul Brood	Sacbrood
Hartford County—*Con.*							
East Hartford......	3	0	18	0	0	0	0
East Windsor......	8	0	81	0	0	0	0
Enfield............	6	0	38	0	0	0	0
Farmington........	18	0	68	0	0	0	0
Glastonbury......	19	1	144	1	0	1	0
Granby...........	8	0	87	0	0	0	0
Manchester........	11	0	71	0	0	0	0
New Britain.......	8	0	118	0	0	0	0
Newington.........	6	0	74	0	0	0	0
Plainville..........	3	0	7	0	0	0	0
Rocky Hill........	4	0	25	0	0	0	0
Simsbury..........	4	0	45	0	0	0	0
Southington.......	8	0	40	0	0	0	0
South Windsor.....	7	0	32	0	0	0	0
Suffield...........	12	1*	93	3*	0	1	0
West Hartford.....	15	0	74	0	0	0	0
Wethersfield.......	2	0	10	0	0	0	0
Windsor...........	1	0	9	0	0	0	0
Windsor Locks.....	2	0	11	0	0	0	0
	199	2*	1,485	4*	0	2	0
Tolland County:							
Andover...........	6	0	36	0	0	0	0
Bolton............	6	0	15	0	0	0	0
Columbia..........	3	0	7	0	0	0	0
Coventry..........	13	0	61	0	0	0	0
Ellington..........	4	0	14	0	0	0	0
Hebron...........	4	0	26	0	0	0	0
Mansfield.........	3	0	28	0	0	0	0
Somers............	3	0	14	0	0	0	0
Vernon............	1	0	13	0	0	0	0
	42	0	214	0	0	0	0
Windham County:							
Brooklyn..........	2	0	176	0	0	0	0
Canterbury........	2	0	18	0	0	0	0
Chaplin...........	1	0	3	0	0	0	0
Eastford..........	6	0	18	0	0	0	0
Hampton..........	11	0	60	0	0	0	0
Killingly..........	13	2	46	4	3	1	0
Plainfield.........	20	1	111	1	0	1	0
Pomfret...........	12	1	88	2	0	2	0
Putnam...........	5	1	32	1	0	1	0
Sterling..........	2	2	8	3	0	3	0
Windham.........	7	0	67	0	0	0	0
Woodstock........	14	0	110	0	0	0	0
	95	7	737	11	3	8	0

* 2 colonies with Paralysis.

SUMMARY.

County	No. of Towns	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased	American Foul Brood	European Foul Brood	Paralysis	Sacbrood
Fairfield	16	81	7	945	12	8	0	0	4
New Haven	17	103	4	980	11	9	0	0	2
Middlesex	13	66	5	790	8	2	6	0	0
New London	12	45	3	946	4	0	4	0	0
Litchfield	15	94	5	705	9	0	5	4	0
Hartford	25	199	2	1,485	4	0	2	2	0
Tolland	9	42	0	214	0	0	0	0	0
Windham	12	95	7	737	11	3	8	0	0
	119	725	33	6,802	59	22	25	6	6

	No. Apiaries	No. Colonies
Inspected	725	6,802
Infested with European foul brood	17	25
Per cent. infested	2.34	.36
Infested with American foul brood	7	22
Per cent. infested	.965	.323
Sacbrood	4	6
Bee paralysis	5	6
Average number of colonies per apiary		9.38
Cost of Inspection		$1,849.80
Average cost per apiary		$2.55
Average cost per colony		.27

REGISTRATION OF BEES.*

Many beekeepers are not complying with the law in regard to the annual registration of bees. They seem to think that if they register once, they need not do so again, but the law requires them to register each year before October 1st. This law is Chapter 174 of the Public Acts of 1919, and reads as follows:

"Section 1. Every person owning one or more hives of bees shall, annually, on or before the first day of October, make application to the town clerk of the town in which such bees are kept, for the registration of such bees, and such town clerk shall issue to such applicant a certificate of registration upon the payment of a recording fee of twenty-five cents, which certificate shall be in the form prescribed and upon blanks furnished by the commissioner of domestic animals and shall be recorded in the office of such town clerk.

Sec. 2. A record of such registration with the name and place of residence of the registrant and the definite location in the town where bees are kept by him shall be recorded in a separate book in the office of the town clerk, which records shall be accessible to the public.

Sec. 3. Any owner of bees who shall fail to register as required by the provisions of this act shall be fined not more than five dollars."

*Published as Bulletin of Immediate Information No. 27, September 15, 1923, and sent to the newspapers, all town clerks, and to all beekeepers where inspections have been made during the past four years.

An amendment to this law was passed at the last session of the General Assembly (see Chapter 129, Public Acts of 1923) as follows:

"Section two of chapter 174 of the public acts of 1919 is amended to read as follows: A record of such registration and of the name and place of residence of the registrant and the definite location in the town where bees are kept by him shall be kept in a separate book in the office of the town clerk, which record shall be accessible to the public. Each town clerk shall file with the state entomologist of the Connecticut Agricultural Experiment Station a complete list of such registrations and locations on or before the first day of February of the year succeeding such registrations. Any town clerk failing to perform such duty shall be fined not more than ten dollars."

Therefore in order to comply with the Statutes, each beekeeper should register his bees each year before October 1st, with his town clerk, and each town clerk must send to the State Entomologist before February 1st, a list of the beekeepers who have registered in that town.

REPORT OF GIPSY MOTH WORK.

Year ending June 30, 1923.

By John T. Ashworth and W. E. Britton.

This work has been conducted in about the same manner as in former seasons and the methods were described in considerable detail in the Report of this Station for 1922, pages 290-326. The satisfactory co-operation between the State and Federal forces has continued, the Federal men for the most part working along the outside border of the infested area with a view of expending a major portion of the Federal appropriation in preventing the further spread of the pest. The present writers hereby express to Messrs. A. F. Burgess, in charge of moth work, and Harry E. Blaisdell, in charge of scouting and extermination work, their cordial appreciation of the aid received from Federal sources.

During most of the season 30 men have been employed by the State on gipsy moth work. Except for the wind-spread of a few years ago, which greatly increased the area infested and rendered the fixed appropriation inadequate to cover the territory, the pest has been kept well in check. There has never been any stripping of trees or noticeable injury in Connecticut caused by the gipsy moth.

Details of the season's work will be found in the following pages.

New Equipment.

Two new Ford light trucks have been purchased during the year and are used to transport scouting crews back and forth between the field and the boarding and lodging places. One Ford touring car was replaced by a new one in September, 1922.

Windham County.

This County, situated in the northeastern corner of the State and bordered as it is by Massachusetts on the north and by Rhode Island on the east, was the first part of the State to become generally infested, and is now as in former years the most heavily infested portion of the State, although no stripping has ever been found in Connecticut up to this time. The work of the past year in Windham County was all done by the State forces except in the towns of Thompson, Putnam and Pomfret; these towns were used as schools to teach and break in new men for the Federal Government, our own foreman being in charge but on the Federal pay roll. The table of statistics on page 262 shows the degree of infestation in each town.

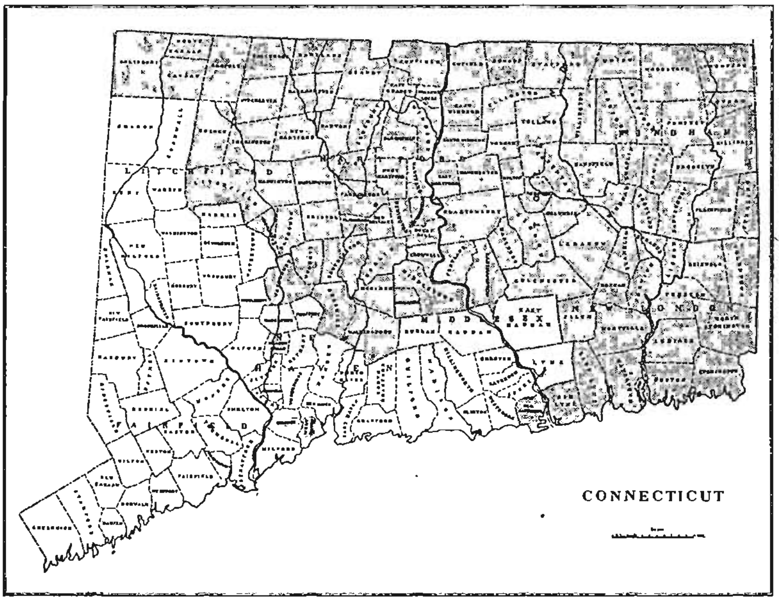

Figure 9. Map of Connecticut showing territory quarantined in 1923 on account of gipsy moth

In the towns of Canterbury, Chaplin, Hampton, Plainfield and Sterling, the infestations were all small and not worthy of particular mention.

In Ashford, one colony of 107 egg-clusters was found in woodland on the western side of Biglow brook on land owned by G. H. Myers of Union, Connecticut.

Brooklyn had one colony which was considered dangerous, 47 egg-clusters being found on an oak tree in an open pasture owned

by Patrick Moran near the junction of the State road and the Allen Hill road.

In Eastford two large colonies were found, both woodland infestations, one of 191 egg-clusters just south of Crystal Lake on land owned by Andrew Chilkott, and the other on land owned by Mr. Floating about two miles west of Eastford Post Office on the eastern edge of Nachaug River, containing 249 egg-clusters.

Killingly was not entirely scouted as the egg-masses were hatching before the work could be completed. One colony of 40 egg-clusters was found in a pasture orchard owned by C. W. Williams and situated along the Quinebaug River near what is known as the Ox-bow.

Pomfret as stated above was used as a school to train men, and the scouting was not completed; all colonies found were small.

In the town of Putnam the conditions were similar to those in Pomfret.

The worst colony in Scotland, though one easily handled, was found in an orchard owned by Mr. B. Ashley on the road leading off the State road just west of where Merrick brook crosses the State road; 26 egg-masses were found here.

Sterling was scouted the last of the season, and all infestations found were small and not considered dangerous.

Scouting in Thompson was not completed on account of lack of time, men, and money. Most of the work was confined to the western half of the town, and conditions were found to be about the same as last year. One colony of 135 egg-clusters was discovered in an old orchard owned by D. H. Cortiss just north of his home. The other infestations were small and easily handled.

Windham had two large colonies, both of which were found in orchards owned by Mr. W. A. Standish in North Windham, one of 31 egg-clusters in cherry trees and one of 84 egg-clusters in apple trees. Both of these colonies were very easy to spray and watch.

New London County.

With the exceptions of the towns of Lyme, Old Lyme and East Lyme, all work in New London County was done by State crews this year. The above named towns were scouted by Federal men.

In Bozrah one old egg-cluster was found near the Norwich town line on Wawecus Hill.

Colchester was scouted only in the eastern half, one colony of five egg-clusters being found on land owned by Barnet Rabenowitz, situated south of the Norwich-Colchester State road, near the Lebanon town line.

There were two groups of colonies found in East Lyme. One group contained two infestations situated in the northeastern part of the town near the Montville line: one of these had 10 egg-

clusters and was on land owned by Peter Trasco. The other group was in Niantic in the southern end of the town along the coast line; two colonies in this group were considered dangerous, one of 15 egg-clusters on land owned by F. E. Temple and one of 13 egg-clusters on land owned by H. B. Morton, both being found on apple trees in the Niantic section of the town. Forty trees were banded in the spring by Federal men.

In the town of Griswold two bad colonies were found, both in the vicinity of Hopeville and both on apple trees, one of 44 egg-clusters on land owned by William Lord, and one of 20 on land owned by Mr. York.

In scouting Groton this year, the town was found practically free from the gipsy moth, except in the villages of West Mystic and Groton where a number of infestations of one and two egg-clusters were found. One colony of 37 egg-masses was found on apple trees owned by E. D. Bengemor and C. R. Heath in the northern part of West Mystic.

One colony of 20 egg-clusters was found in Lebanon. This colony was in a large oak, on land owned by Mr. Sam Lubetsky in the western end of the town about one mile south of Brewster pond.

All of the colonies in Ledyard were small, an infestation of six egg-clusters being the largest.

Lisbon had one colony of eight egg-clusters on two white oaks in the southern end of the town between the railroad and Quinebaug River, on land owned by James McCanne.

None of the infestations found in New London were large or dangerous, one of five egg-clusters being the largest; this colony was found on three maples at Mrs. Gutri's home on the lower boulevard.

The infestations in Norwich were all in the southeastern part of the town, with the exception of one of five egg-clusters found on apple trees on property owned by Joe Lamoth in Taftville; the only colony that was of any size was in two apple trees in the yard of Philip Werster in the western part of the city section, 17 egg-clusters being found.

The usual roadside scouting was not done in North Stonington this season, but some woodland work was done early in the fall; one colony of 17 egg-clusters was found in woodland near the Westerly town line in the southeastern corner of the town.

Old Lyme had three colonies, two of them being large for this territory. One was found on the north side of the State road near Rogers Lake in some pasture oaks owned by Ernest Rogers, where 16 egg-clusters were found; the other was a colony of 12 egg-clusters in apple trees around a house owned by Walter H. Hanems, situated in the Black Hall district. Sixty-one trees were banded and spraying was done at all of the infestations by Federal men.

On account of the lateness of the season the scouting in Preston had to be done in a hurried manner and one colony of 35 egg-clusters was found in woodland owned by S. F. Pierce, situated in the eastern part of the town along the west branch of Broad Brook; the other infestations were all small.

Salem was scouted but no trace of the gipsy moth found.

In Sprague, all three of the infestations were in the northeastern part of the town near Hanover. One of 17 egg-clusters was found in a roadside orchard owned by William Westburg, another of five egg-clusters in a roadside white oak owned by Nicholas Kaletchi. Both of these colonies were sprayed. The other infestation was small, two old egg-clusters being found there.

Stonington was found to be generally but not heavily infested. Two of the largest colonies are herein mentioned; one of 71 egg-clusters found on a large oak in a pasture owned by Silas Wheeler in Old Mystic; the other was in an old orchard in the Wequetequock section where 27 egg-masses were found.

In Voluntown, the infestations were all small, the largest being one of 15 egg-clusters on two apple trees located near the Sterling line, owned by William Jarvis. One of 12 egg-clusters in an apple orchard near the center of the town might be mentioned, but the rest were all very small.

Three infestations were found in Waterford; all were small, three egg-clusters being the largest.

Lyme was scouted but nothing was found.

TOLLAND COUNTY.

All work in Tolland County this year was done by State crews. The towns along the northern edge of the county, on the Massachusetts border, were the most heavily infested; the rest of the county being comparatively free from this pest, some of the towns having only a single infestation.

Two colonies were found in the northern part of Andover, one of nine egg-clusters in white oaks owned by George Terstin and D. Keefe; the other of 12 egg-clusters was in apple trees owned by A. E. Samuels.

One colony and a single egg-mass were found in Bolton. Both were in apple trees. At the colony 16 egg-clusters were found in an orchard owned by B. Andsaldi near the Hebron town line.

Two small colonies and a single egg-cluster were found in Columbia; all were near together in the southwestern corner of the town near the Hebron town line. These colonies contained three and four egg-clusters respectively and were found in apple trees owned by Mr. C. L. Robinson and J. Kemvitz.

The scouting in Ellington had to be stopped on account of deep snow, but later in the season the work was taken up and the town finished; in fact all the crews in this district were moved at this

time to the southern part of the State around New London. Three of the largest colonies are herein mentioned. One of 79 egg-clusters was found in an orchard owned by Frank Gotcha about one mile south of Soapstone mountain; another of 46 egg-clusters was in apple and oak trees owned by Charles Thompson in the northwestern corner of the town. The third was one of 36 egg-clusters found in an oak owned by Clarence Clark near the Ellington railroad station.

Nothing was found in Hebron, but while scouting the town, some of the men got over the line into the northeastern corner of Marlborough and found three old egg-clusters in a white oak on land owned by Joseph Soglio; it was a question whether they were in Hebron or Marlborough, but the foreman charged them up to Hebron.

Somers was found to have infestations distributed over the entire town, none of which were very large. Two of 36 egg-clusters each were the largest. One of these colonies was in an orchard owned by Mr. Miller just west of Bald Hill; the other was found in two white oaks in a field in the village of North Somers. Another colony of 37 egg-clusters was found in a white oak owned by M. Keeney in the southwestern part of the town. These three and a number of smaller infestations were sprayed in the spring.

By looking at the table of statistics any one would think that Stafford (with its 142 infestations) was literally covered with gipsy moths, but such is not the case; the town is generally infested but not so badly as it seems. Single egg-clusters were called infestations in this town, and as there are a great many of them, it makes the degree of infestation look more serious than it really is. The largest colony contained 170 egg-clusters in apple trees and one maple tree owned by John Kellog located about one and one-half miles south of State Line pond. This was easily handled. Another large colony of 63 egg-clusters was found in a white oak in a woodland margin about one mile southwest of the West Stafford Post Office. Though the above mentioned colonies were the largest ones found, there were four other of 40 egg-clusters and several smaller ones which were all sprayed by State men in the spring.

Three small colonies were found in Tolland in addition to a number of single egg-cluster infestations. Fifteen egg-clusters were found in an orchard owned by Mike Barezczski, and another of 21 egg-clusters in five oaks owned by John E. Clough, both of which were situated a little north of Tolland village. The third colony was one of 21 egg-clusters in one apple tree and a stone wall on land owned by Charles Woçkomocker, about one mile west of the South Willington railroad station.

In Union two large colonies were found in the extreme northwestern corner of the town, both in apple trees, one of 41 egg-clusters on land owned by Myron Heck, the other of 77 egg-

clusters on the property of A. B. Wells. The largest colony found in the town was on the north shore of Mashapaug Lake on land owned by Dwight L. Crawford, 80 egg-clusters being found. The other 23 infestations in the town were small, containing from five to eight egg-clusters each.

Ninety-five of the 129 egg-clusters found in Vernon this season were on one apple tree owned by Peter Swanick in Rockville. The rest of the infestations were all small and in the Rockville section of the town.

The towns of Willington and Mansfield were not scouted this year on account of shortage of men and lack of time.

HARTFORD COUNTY.

Part of the work in Hartford County was done by Federal men and part by State men. Some of the towns which were scouted last year were not covered this year on account of a shortage of trained men and money, as the towns along the Massachusetts border further west had to be given attention.

Berlin was scouted by Federal men and three infestations found, all of them in the southern part of the town. One infestation of six egg-clusters was found on a walnut tree owned by James Derby; another of three egg-clusters in an oak and apple tree owned by the Connecticut Orchard Company, and the third of seven egg-clusters in apple trees owned by John T. Molumphy.

Federal men also did the work in Bloomfield, where five infestations were found, two of which were large colonies; one containing 40 egg-clusters was found on a large oak on land owned by J. S. Lagan, and the other of 15 egg-clusters was in an orchard owned by W. J. Cooley. All five of the infestations were in the southern end of the town along the Hartford and West Hartford borders. Twenty-three trees were banded and later 40 trees sprayed by Federal men.

All work in Bristol was done by Federal men and two small colonies found. One colony of 20 egg-clusters was found in the extreme northeastern corner of the town on apple trees owned by William Harding, and the other colony was one of eight egg-clusters in an orchard owned by M. Levinska, located about half way between Bridge pond and the Bristol reservoir. Ten trees were banded and 50 sprayed in the spring.

The work in Enfield was done by State men, nine infestations being found, of which two were large for this section of the State; one contained 29 and the other 15 egg-clusters. Both of these colonies were found in apple trees owned by George Hardiman and Eugene Quinn, and both were in the Thompsonville district; the other infestations were all small.

State men did the work in East Windsor, where most of the infestations were small. Two, however, were very bad. One of

109 egg-clusters was found in five apple trees in a dooryard on the Simon Miskill Estate at Broadbrook, and the other in a white oak at Warehouse Point owned by William Trombley, where 163 egg-clusters were found.

Newington was scouted by Federal men and two infestations found; one contained 29 egg-clusters in an apple tree owned by Mrs. McIncony on Robbins Avenue, the other eight egg-clusters in oak and walnut trees owned by Peter Albersom on Church Street. Spraying was done by Federal men at both places.

Two large colonies were found in New Britain by Federal men, one of 11 egg-clusters on Maple Street in mixed growth on the property of P. J. Curtiss, and the other was in the center of the town on land owned by Peter Kalashenok, containing 83 egg-clusters. Thirty-six trees were banded and later 12,000 trees sprayed by Federal men.

In Rocky Hill two colonies were found, one of four egg-clusters on willows on the Connecticut River bank in the southeastern corner of the town, and the other of two egg-clusters was on Parsnig Street on apple trees owned by W. F. Griswold. The work in this town was done by Federal men.

State men found two colonies in South Windsor which are worthy of mention. One of 18 egg-clusters occurred in maple trees in the center of the town, and the other, containing 12 egg-clusters, was in the northwestern corner of the town on poplar trees owned by Mrs. Louis Speny. The other four infestations were all small and not dangerous.

No roadside scouting was done in Simsbury this year, but early in the fall 1,247 acres of woodland were scouted and nothing found.

Other towns in Hartford County that were scouted and found free from the gipsy moth were Plainville, Southington and Suffield.

Litchfield County.

The work in Litchfield County was done by the Federal forces. Six towns were found to be infested with the gipsy moth, namely: Canaan, Goshen, Litchfield, Plymouth, Salisbury and Winchester; these towns were very slightly infested.

In Canaan three colonies were found, the largest being one of eight egg-clusters in apple and elm trees owned by Miss Ida L. Root, about one mile west of Wangum Lake; the other two were found in willow trees owned by N. C. Dean and W. E. Shepard, both in the Falls Village section of the town. At N. C. Dean's place the colony contained four egg-clusters, and that at W. E. Shepard's had seven egg-clusters.

One colony of eight egg-masses was found in Goshen on a willow tree owned by F. S. Johnson, just south of the Goshen Post Office.

Both colonies found in Litchfield were in the northeastern corner of the town on the State road between Litchfield and

Torrington; one had 12 egg-clusters and the other only a single egg-cluster, all on apple trees in a pasture owned by F. W. Fuessenick and P. C. Burke.

In Plymouth one colony of 16 egg-clusters was found in some oak and maple trees owned by H. Mahoney, this colony being located in the southeastern corner of the town near Hancock Station.

Two large colonies were found in Salisbury on land owned by T. Burnetti about one mile north of Salisbury Post Office on the western side of Moore Brook; one in white oak growth contained 31 egg-masses and the other in apple trees had 21 egg-masses. Two other small infestations were also found in this town, one a single egg-mass on an apple tree owned by C. C. Lansing in Amesville, and another of three egg-clusters in a white oak owned by F. E. Howd about one mile north of Lakeville.

In Winchester one egg-cluster was found on an apple tree in Winchester Center, owned by E. W. Esenlohr, and a colony of eight egg-clusters on apple trees owned by W. W. Greene in Winsted.

In the spring and early summer 166 trees were banded and later 113 trees and five and three-fourths acres of woodland were sprayed at the above mentioned infestations.

The following towns in Litchfield County were scouted but no gipsy moths found in them: Kent, Morris, North Canaan, Sharon, Thomaston, Torrington, Warren, Watertown and Washington.

Middlesex County.

The entire County was scouted, except portions of the towns of East Haddam and Killingworth, which were not completed, although considerable work was done in them. Two towns were found infested with gipsy moths, Old Saybrook and Middletown.

In Old Saybrook two single egg-clusters were found, one on the Frank Negrelli Estate in the northern part of the town, and the other on property owned by Mrs. Bogue about one mile southwest of Saybrook Junction.

In Middletown two infestations of two egg-clusters each were found in the southeastern corner of the town on land owned by August Strom and the Green Meadow Club. Two infestations, one of two and another of one egg-cluster, were found on land owned by C. L. Johnson near Bear Hill. The last infestation was a single egg-mass on land owned by C. S. Wadsworth near Long Hill.

The towns of Chester, Clinton, Cromwell, Durham, East Hampton, Essex, Haddan, Portland, Saybrook and Westbrook were scouted but no trace of the pest found. The work in this County was all done by Federal men.

New Haven County.

Four towns were found infested with the gipsy moth in New Haven County this year, namely: Cheshire, Wallingford, Waterbury and Wolcott, one colony being found in each town.

The colony in Cheshire was one of 31 egg-clusters found in maple trees owned by A. H. Northrop, in the northeastern corner of the town near the Southington line.

The colony in Wolcott was a reinfestation from last year's colony, and was in oak trees owned by Peter Fontano about one mile north of Wolcott Post Office, containing seven egg-clusters; last year 19 were found and it is hoped that this colony has now been eradicated.

The Waterbury colony was one of eight egg-masses in maple trees owned by Mike Jenity of 792 Highland Avenue.

The gipsy moth has again made its appearance in Wallingford, but not in such abundance as in 1909, when more than 8,000 egg-clusters were creosoted. This year only three egg-clusters were found in an orchard owned by George Scards about a mile west of Pistapaug Pond.

At the above mentioned colonies, 33 trees were banded and 26 sprayed in the spring and early summer.

Other towns in this County which were scouted and not found infested were: Hamden, Meriden, Middlebury, Naugatuck, North Haven and Prospect. The work in this County was done by Federal men.

Spraying.

The foregoing summary has not covered the spraying done by the State department. The reason for this is that the Federal and State departments have a different method of reporting this branch of the work.

During this spraying season the weather was very favorable, practically no time being lost on account of rainy weather. This, together with the generosity of the Federal Bureau in lending the State a complete spraying truck and driver, are the two factors that enabled the State department to spray all of the infestations which needed spraying in the Counties of Windham, New London, Tolland and Hartford, east of the Connecticut River. The table of statistics shows the number of colonies sprayed in each town.

Statistics of Infestations.

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae Killed
Windham County—15 Towns Infested.					
Ashford	19	400	7	169	240
Brooklyn	25	329	21	237	40
Canterbury	6	98	5	22	3
Chaplin	7	86	6	105	26

STATISTICS OF INFESTATIONS—*Continued.*

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae Killed
Windham County—*Concluded.*					
Eastford	44	1,211	15	278	961
Hampton	7	89	7	87	262
Killingly	13	193	9	85	189
Plainfield	4	68	11	82	100
Pomfret	18	145	7	37	843
Putnam	22	311	18	115	346
Scotland	10	57	2	10	3
Sterling	4	56	12	102	26
Thompson	78	1,361	19	390	543
Windham	18	233	9	65	63
Woodstock*	7	207	0	0	0
	282	4,844	148	1,784	3,645
New London County—17 Towns Infested.					
Bozrah	1	1	0	0	0
Colchester	1	5	1	4	5
East Lyme	9	52**	0	0	0
Griswold	17	144	6	47	41
Groton	33	137	10	60	21
Lebanon	3	27	3	40	2
Ledyard	9	27	2	15	15
Lisbon	3	10	0	0	375
New London	10	25	4	34	26
Norwich	7	36	3	9	1
No. Stonington	1	17	0	0	0
Old Lyme	3	32	0	0	0
Preston	3	40	1	12	410
Sprague	3	24	2	25	0
Stonington	25	367	15	184	71
Voluntown	12	53	2	7	817
Waterford	3	6	2	6	33
	143	1,003	51	443	1,817
Tolland County—10 Towns Infested.					
Andover	2	22	1	7	4
Bolton	2	17	1	6	0
Columbia	3	8	2	12	5
Ellington	21	284	9	75	156
Hebron	1	3	1	25	0
Somers	41	360	16	149	28
Stafford	142	1,281	25	233	2,038
Tolland	11	67	1	7	1
Union	26	467	14	154	146
Vernon	13	129	4	20	19
	262	2,638	74	688	2,397

* In Woodstock, only woodland scouting was done, in late summer.
** Plus one pupa.

STATISTICS OF INFESTATIONS—*Continued.*

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Trees Sprayed	No. Larvae Destroyed	No. Bands Applied	No. Miles Roadway Scouted
Hartford County—10 Towns Infested.						
Berlin	3	16	32	0	14	67
Bloomfield	5	68	40	0	23	38
Bristol	2	28	50	0	10	104
East Windsor	10	298	66	359	0	79
Enfield	9	74	97	347	0	102
New Britain	2	94	1,200	0	36	40
Newington	2	37	1	0	1	37
Plainville	0	0	0	0	0	53
Rocky Hill	2	6	0	0	0	40
Southington	0	0	0	0	0	110
South Windsor	6	39	113	14	0	60
Suffield	0	0	0	0	0	3
Windsor Locks	1	4	0	0	0	10
	42	664	1,599*	720	84	*743
Litchfield County—6 Towns Infested.						
Canaan	3	19	83	0	63	52
Goshen	1	1	0	0	20	95
Kent	0	0	0	0	0	15
Litchfield	2	13	5	0	13	51
Morris	0	0	0	0	0	44
North Canaan	0	0	0	0	0	19
Plymouth	1	16	0	0	22	79
Salisbury	4	56	15	0	59	105
Sharon	0	0	0	0	0	5
Thomaston	0	0	0	0	0	55
Torrington	0	0	0	0	12	58
Warren	0	0	0	0	0	33
Washington	0	0	0	0	0	38
Watertown	0	0	0	0	0	93
Winchester	2	9	10	0	11	112
	13	114	113**	0	200	854
Middlesex County—2 Towns Infested.						
Chester	0	0	0	0	0	37
Clinton	0	0	0	0	0	52
Cromwell	0	0	0	0	0	42
Durham	0	0	0	0	0	64
East Haddam	0	0	0	0	0	14
East Hampton	0	0	0	0	0	18
Essex	0	0	0	0	0	37
Haddam	0	0	0	0	0	125
Killingworth	0	0	0	0	0	76
Middlefield	0	0	0	0	0	35
Middletown	5	8	37	0	23	167
Old Saybrook	2	3	0	0	0	36
Portland	0	0	0	0	0	69
Saybrook	0	0	0	0	0	33
Westbrook	0	0	0	0	0	36
	7	11	37	0	23	841

* Also 2.5 acres of woodland sprayed; and 175 acres of woodland scouted in Berlin and 1,247 acres in Simsbury.

** Also 5.75 acres of woodland sprayed.

STATISTICS OF INFESTATIONS—*Concluded.*

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Trees Sprayed	No. Larvae Destroyed	No. Bands Applied	No. Miles Roadway Scouted
New Haven County—4 Towns Infested.						
Cheshire.........	1	29	8	0	4	93
Hamden.........	0	0	0	0	0	48
Meriden.........	0	0	0	0	0	96
Middlebury......	0	0	0	0	0	76
Naugatuck.......	0	0	0	0	0	86
North Haven....	0	0	0	0	0	20
Prospect.........	0	0	0	0	0	35
Wallingford......	1	3	0	0	17	116
Waterbury.......	1	8	8	0	6	142
Wolcott.........	1	7	10	0	6	53
	4	47	26	0	33	765

SUMMARY OF STATISTICS.

County	No. Towns Covered	No. Infes-tations	No. Egg-Clusters Destroyed	No. Infestations Sprayed	No. Trees Sprayed	No. Lbs. Arsenate Used	No. Trees Banded	No. Larvae Destroyed	No. Mi! Roadw. Scoute
indham	15	282	4,844	148	0	1,784	0	3,645	0
ew London	20	143	1,003*	51	0	443	0	1,817	0
lland	10	262	2,638	74	0	688	0	2,397	0
rtford	15	42	664	0	1,599†	0	84	720	743:
tchfield	15	13	114	0	113†	0	200	0	854
iddlesex	15	7	11	0	37	0	23	0	841
ew Haven	10	4	47	0	26	0	33	0	765
	100	753	9,321*	273	1,775	2,915	340	8,579	3,203

PARASITES LIBERATED IN 1923.

Full details regarding the parasites of the gipsy moth and their distribution in Connecticut may be found in the Report of this Station for 1922 (22nd Report of the State Entomologist), page 313. The Japanese egg parasite, *Schedius kuvanae* How., is mentioned on page 315. During 1923, large numbers of these tiny parasites were sent into Connecticut from the Government Parasite Laboratory at Melrose Highlands, Mass., and put out by Mr. McEvoy in the more thickly infested gipsy moth territory in the eastern part of the State, particularly Windham and New London Counties. The number of individual parasites liberated in each town are as follows:

WINDHAM COUNTY.

Ashford.................	64,000	Plainfield................	20,000
Brooklyn................	56,000	Pomfret..................	60,000
Canterbury..............	24,000	Scotland.................	32,000
Chaplin.................	24,000	Sterling.................	17,850
Eastford................	96,000	Windham................	32,000
Hampton................	40,000		

* Also 1 pupa.
† Also 2.5 acres woodland in Hartford County and 5.75 acres in Litchfield Count
:ayed.
., Also 1,422 acres of woodland scouted in Hartford County.

Tolland County.

Somers	20,000	Stafford	24,000

New London County.

Colchester	4,000	North Stonington	4,000
East Lyme	17,900	Norwich	24,000
Griswold	40,000	Old Lyme	12,000
Groton	20,000	Preston	12,000
Lebanon	9,850	Sprague	12,050
Ledyard	12,000	Stonington	28,000
Lisbon	20,000	Voluntown	32,000
New London	28,000	Waterford	12,000

Windham County	465,850
Tolland County	44,000
New London County	287,800
Total liberated in 1923	797,650
" " " 1922	904,000
" " " 1921	1,598,775
Total liberated in Connecticut	3,300,425

Appropriations.

The appropriation for the biennial period ending June 30, 1923, was $60,000.00. On account of the extensive increase because of wind-spread, it became apparent that more money would be needed and the legislature then in session was asked for an additional $10,000.00. This was granted in the form of a deficiency appropriation and became immediately available for the remainder of the fiscal period. The legislature also granted the full amount requested ($100,000.00) for the biennial period ending June 30, 1925.

Gipsy Moth Suppression Account.

Financial Statement.

RECEIPTS

Appropriation for biennial period ending June 30, 1923	$60,000.00
Expended, year ending June 30, 1922	30,301.77
Balance	$29,698.23
Deficiency appropriation, 1923	10,000.00
	$39,698.23

Classified Expenditures for the Year Ending June 30, 1923.

Salaries and Wages	$31,163.59
Printing and Illustrations	32.65
Postage	.50
Stationery	41.73
Telegraph and Telephone	19.66
Insurance (supplies including horse sprayer)	51.40
Spraying Supplies	2,200.60

Machinery, Tools and Supplies		$ 280.11	
Express, Freight and Cartage		63.51	
Rental and Storage		441.00	
Automobiles: New	$1,240.44		
Insurance	172.86		
Supplies and Equipment	730.40		
Repairs	878.49		
Gasoline	1,729.39		
Oil	78.47		
		$4,830.05	
Traveling Expenses		229.94	
Inspection of Imported Nursery Stock		288.11	
Heat and Light		55.10	
			$39,697.95
Balance			.28
			$39,698.23

EXPERIMENTS IN DUSTING VERSUS SPRAYING IN CONNECTICUT APPLE ORCHARDS IN 1923.

By M. P. Zappe and E. M. Stoddard.

The experiments with dusts in comparison with sprays for the control of various insect and fungous pests of apple and peach orchards begun in 1920 have been continued each year since. In 1923, only apple orchards were treated, and though the results so far as the control of insects are concerned do not differ greatly from the results of preceding years, it seems best to present them here as a matter of record.

The results of preceding experiments along this line may be found in the publications of this Station as follows: Report for 1920, page 168, results of 1920; Bulletin 235, results of 1921; Bulletin 245, results of 1922.

Acknowledgments.

The writers are indebted to Mr. Frank N. Platt of Milford for the use of his orchard, power sprayer and for other assistance in conducting these experiments. Mr. George Graham helped in the application of the spray and dusts and in the work of harvesting and scoring the fruit. Messrs. B. H. Walden, J. L. Rogers, T. F. Cronin and S. R. Hamilton also helped in harvesting and scoring the fruit.

Orchards Under Experiment.

Only two apple orchards were used for this work in 1923, and both have been used in the prior tests. The largest of these was the orchard of Frank N. Platt, Milford, containing 285 trees, 19 years old. The other was the old orchard at the Station Farm, Mount Carmel, containing 40 trees about 47 years old.

Apparatus Used.

The spray outfit was the same as used in preceding experiments, a Friend power sprayer with tank of 200 gallons capacity. Two lines of hose were used with two nozzles on each rod, carrying between 175 and 200 pounds pressure. The duster was a Niagara power outfit purchased new in 1923. It was mounted upon skids so that it could be readily transferred to an automobile truck. It is similar to the duster used in preceding experiments except that it is lighter, has an improved type of engine and blower and so probably gave somewhat better results.

Materials.

For the spray solutions the following materials were used:

Lead arsenate	3 pounds
Liquid lime-sulphur	3 gallons
Casein spreader	¾ pound
Water	100 gallons.

Only two kinds of dust were used in the tests in 1923. One was a sulphur-lead-arsenate dust containing fine sulphur, 90 parts, and lead arsenate, 10 parts. The other was a copper-arsenic dust containing 5.75 per cent. of metallic copper and 2.75 per cent. of metallic arsenic. The percentage of lime was not determined. When applied to moist foliage this dust immediately turns a bluish color, indicating the formation of a Bordeaux mixture on the foliage.

Number and Time of Applications.

Seven applications were made in the Milford orchard on the following dates:

1.	Delayed dormant	April 25–26.
2.	Prepink, treatment	May 4.
3.	Pink, treatment	May 10.
4.	Calyx, first after blossoming	May 24–28.
5.	Second after blossoming	June 12.
6.	Third after blossoming	July 6.
7.	Fourth after blossoming	August 1.

At the Station Farm, only dusts were used, three applications being made after blossoming, on May 29, June 13 and July 12-13.

Recording Data.

Trees which blossomed freely were selected as count trees. The fruit was kept separate and each apple scored for insect and fungous injury. All injuries on each fruit were recorded, even though slight, and often several kinds of injury were noted on a single apple; in such cases all types of injury were recorded separately. Later these figures were tabulated and percentages obtained. Altogether this work necessitated the separate handling and scoring of 144,895 individual apples, equivalent to about 362 barrels.

Milford Orchard.

The experiments in this orchard included four varieties: Gravenstein, McIntosh, Baldwin and Greening, but only the McIntosh

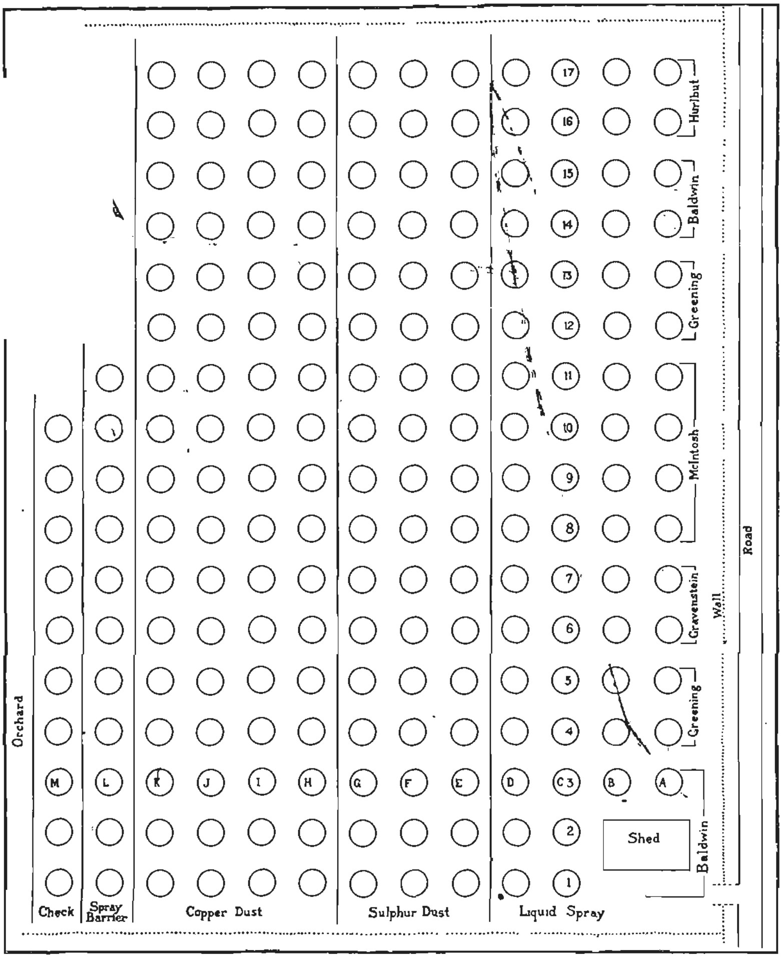

Figure 10. Plan showing arrangement of experimental plots in orchard of Frank N. Platt, Milford, where experiments in dusting and spraying were conducted in 1923.

produced a good crop of fruit. The other varieties bore a very light crop and in some plots there were not enough apples of one variety to give adequate data. The plots were so arranged that each plot contained trees of each variety.

The arrangement of the plots is shown in Figure 10, and was as follows: beginning on the east side, the first four rows were sprayed. Rows five to seven were dusted with sulphur-arsenate dust. Rows eight to 11 were dusted with copper-arsenic dust. Row 12 was sprayed and acted as a barrier to keep the dust from being blown from row 11 to row 13, which was untreated and used as a check.

The first treatment in this orchard was the delayed dormant spray of lime-sulphur which was applied over the entire orchard on April 25 and 26. Liquid lime-sulphur, 1-9, was used on the south half of the orchard, and Sherwin-Williams dry lime-sulphur, 25-100, on the north half.

The next treatment was the prepink application on May 4 on the Gravenstein, McIntosh and Greening varieties in the copper-arsenic dust plot only. The other plots were not treated until the next application.

The pink application was given to all varieties in all plots on May 10. The spray was applied first because it was too windy for dusting. Later in the day towards sunset the wind subsided and the dust was applied.

The first treatment after blossoming was applied to the McIntosh trees on May 24. All other varieties in all plots were treated May 28.

The second treatment after blossoming was applied on June 12. The foliage was damp when the dust was applied but had become dry before the liquid spray was applied. There was almost no wind blowing on this date.

The third treatment after blossoming was given on July 6, covering all except one row in each plot, and these rows received no further treatment. The copper-arsenic dust plot began to show considerable scab infection on both the leaves and the fruit. It appeared as though the copper-arsenic dust would not control the scab, so the 90-10 sulphur-arsenate dust was substituted.

The last or fourth treatment after blossoming was applied on August 1, to all except two rows in each plot. The untreated rows included those not given the preceding treatment and one additional row. As before, the sulphur-arsenate dust was substituted for copper-arsenic dust in the copper-arsenic dust plot. Fungous injury was very light except in the case of scab on McIntosh, on all the treated plots and all such injuries are listed under the heading of "all fungi", except in Table 1.

TABLE I. RESULTS OF TREATMENTS. McINTOSH.

No. of Applications	Aphis	Red Bug	Codling Moth	Curculio	Good	Other Insects	Scab
			SPRAY.				
3	0	.29	.29	4.22	93.1	.94	1.55
4	0	.51	.09	2.79	91.5	1.3	3.8
5	0	.36	.02	1.78	96.7	.402	.825

			SULPHUR-ARSENATE DUST.				
3	0	1.26	.17	4.4	87.	1.37	5.27
4	0	1.21	.08	3.72	87.	1.21	7.09
5	0	3.14	.06	4.3	87.5	.68	4.29
			COPPER-ARSENIC DUST.				
4 cop.-ars.	.06	6.2	.19	9.08	19.5	3.26	73.7
4 cop.-ars. } 1 sulp.-ars.	0	4.7	.11	5.1	39.1	2.28	54.5
4 cop.-ars. } 2 sulp.-ars.	0	5.52	.165	8.13	51.5	2.63	27.1
			CHECK.				
No treatment	.134	8.05	9.7	51.0	.335	12.8	96.5

Discussion of Data in Table I.

In nearly every case, plots receiving four and five applications produced a slightly higher percentage of perfect fruit and a lower percentage of injured fruit than plots receiving fewer applications, except in case of the copper dust, where the differences are much greater. Comparing the spray and dust treatments, the former gave slightly better control of all insects, and much better control of scab than either of the dust treatments.

The sulphur-arsenate dust proved more effective against scab than the copper-arsenic dust. McIntosh is a variety much subject to scab attack, and though it was seemingly not a serious scab season, the check or untreated trees showed 96.5 per cent. of scab injury. Where copper-arsenic dust alone was applied this percentage was reduced only to 74, but where sulphur-arsenate dust was substituted for one application the scab injury was cut to 54, and where sulphur-arsenate dust was substituted for two applications, scab injury was still further reduced to 27 per cent. As scab control was the chief aim on this variety, the copper-arsenic dust alone proved very inefficient. On the other hand, where sulphur-arsenate dust was applied in every application scab injury did not go much above seven per cent., while on the sprayed trees it was less than four per cent. The sulphur-arsenate dust was slightly better than the copper-arsenic dust for the control of all insects, though not quite equal to the liquid spray.

The data regarding Gravenstein are presented in Table II.

Table II. Results of Treatments. Gravenstein.

No. of Applications	Aphis	Red Bug	Codling Moth	Curculio	Good	Other Insects	All Fungi
			SPRAY.				
3	8.62	.5	.18	16.3	73.7	1.19	.25
4	3.9	.72	.07	20.8	74.4	.59	.13
5	2.26	.22	0	18.1	79.	.101	.11
			SULPHUR-ARSENATE DUST.				
3	3.64	.178	0	26.3	70.	1.07	0
4	12.8	0	0	26.4	60.8	2.48	.22

			COPPER-ARSENIC DUST.				
4 cop.-ars.	1.03	.079	.55	79.	17.3	7.35	.44
4 cop.-ars. 2 sulp.-ars.	11.5	.222	0	31.6	56.3	3.22	.21
			CHECK.				
No treatment	.65	1.9	5.64	84.	4.05	6.95	49.8

Discussion of Data in Table II.

As the Gravenstein trees bore a light crop of fruit, the data shown in Table II were obtained from comparatively few apples, but are given here for what they are worth. The plots receiving five applications of sulphur-arsenate dust and four applications of copper-arsenic dust bore no apples, so no data are available for these plots. In general the sprayed plots gave a slightly higher percentage of perfect fruit and lower percentages of insect injury than either of the dust plots, and the sulphur-arsenate dust gave rather better results than the copper-arsenic dust. Fungi were inconspicuous on the treated plots, but were conspicuous on the checks, especially Brooks fruit speck.

Similar data on Greening are shown in Table III.

Table III. Results of Treatments. Greening.

No. of Applications	Aphis	Red Bug	Codling Moth	Curculio	Good	Other Insects	All Fungi
			SPRAY				
3	4.32	2.54	1.78	14.2	72.6	2.52	.81
4	5.07	2.56	1.08	7.15	83.	.9	.16
5	1.	2.3	.35	12.1	80.6	1.95	1.4
			SULPHUR-ARSENATE DUST.				
4	.68	.82	1.37	12.1	79.	3.65	1.5
5	.25	.07	.96	6.9	81.9	1.71	1.5
			COPPER-ARSENIC DUST.				
4 cop.-ars.	0	0	3.	36.	52.2	17.2	.74*
4 cop.-ars. 1 sulp.-ars.	0	1.46	23.5	75.	8.8	3.68	6.87*
4 cop.-ars. 2 sulp.-ars.	0	.036	1.81	26.1	60.5	5.43	3.47
			CHECK.				
No treatment	0	8.37	36.	63.6	.24	30.5	43.9

Discussion of Data in Table III.

The Greening crop was also very light and no counts of fruit could be made in the sulphur-arsenate dust plot receiving three applications. There was little difference in the percentages of perfect fruit between the plots treated with liquid spray and with sulphur-arsenate dust; both were better than the copper-arsenic

*Very little fruit in this plot.

dust plot where the percentage of perfect fruit was very low, due largely to curculio injury which ran high. Injury by fungi was best controlled by the spray and sulphur-arsenate dust.

The data on Baldwin are given in Table IV.

TABLE IV. RESULTS OF TREATMENT. BALDWIN.

No. of Applications	Aphis	Red Bug	Codling Moth	Curculio	Good	Other Insects	All Fungi
			SPRAY				
3	.81	.32	.16	12.7	85.	1.05	0
5	.16	.44	1.26	31.7	65.9	1.13	0
			SULPHUR-ARSENATE DUST.				
3	.71	.98	1.23	19.3	75.	2.8	.7
4	2.54	1.88	.94	31.9	56.4	4.23	0
5	.09	.86	.23	16.4	80.	2.1	.01
			COPPER-ARSENIC DUST.				
3 cop.-ars.	.59	4.27	1.57	33.5	51.7	7.7	4.02
3 cop.-ars. } 2 sulp.-ars. }	1.87	4.56	.04	22.7	72.3	2.2	.61
			CHECK.				
No treatment	.22	.44	8.95	42.7	19.	13.8	37.2

DISCUSSION OF DATA IN TABLE IV.

As was the case with Gravenstein and Greening, the Baldwin crop was light and in the plot receiving four spray applications and that receiving four applications of copper-arsenic dust plus one of sulphur-arsenate dust there were no trees which bore fruit; consequently no data could be gathered for these plots. There is little difference here between the liquid spray and sulphur-arsenate plots, and both gave better results than the copper-arsenic dust plots. The percentage of fungous diseases was negligible in the treated plots, but ran quite high in the check plot.

STATION ORCHARD, MOUNT CARMEL.

In this orchard both sulphur-arsenate dust and copper-arsenic dust were used but no liquid spray was applied. Only two varieties, Baldwin and Greening, were under experiment, and on account of the light crop of fruit, the data from both varieties are included in Table V. Each plot received only three treatments of dust, all after blossoming. The calyx treatment was made May 29, and the subsequent applications made June 13 and July 12 and 13. Such data as were obtained are given in Table V as follows:

TABLE V. RESULTS OF TREATMENT. BALDWIN AND GREENING.

Treatment	Aphis	Codling Moth	Curculio	Good	Other Insects	All Fungi
Sulphur-arsenate dust.	7.36	5.95	40.1	43.1	5.74	1.32
Copper-arsenic dust...	2.42	4.48	36.6	54.4	4.1	2.07
Check...............	6.2	22.4	72.5	15.5	6.62	4.45

Discussion of Data in Table V.

In this orchard for some unexplained reason the copper-arsenic dust gave slightly better results in the control of curculio, codling moth and "other insects" than the sulphur-arsenate dust. This is at variance with the results obtained in the Milford orchard where the sulphur-arsenate dust treatment gave higher percentages of perfect fruit and lower percentages of insect injury than the copper-arsenic dust. Fungous troubles were not prominent, though reduced slightly by both treatments.

Conclusions.

In 1923, as in the preceding seasons of 1920, 1921 and 1922, when similar experiments were conducted by this Station, the liquid spray has given somewhat better results in the control of injurious insects and fungi on apple trees in Connecticut than any of the dust mixtures. The difference has not been so great in the control of insects as in the control of fungous diseases. The highest percentage of perfect fruit was obtained from the experimental plots treated with liquid spray.

The sulphur-arsenate dust gave fair control of insect pests and of fungous diseases, particularly apple scab.

The copper-arsenic dust in most cases gave nearly as good control of insect pests as the sulphur-arsenate dust, but was much less effective in controlling fungous diseases, though much better than no treatment.

The season of 1923 was characterized by little rainfall and consequently fungous diseases were not so prevalent as in a normal season or a very moist season. It seems to the writers quite probable that in a dry season like 1923, the dust mixtures would be far more satisfactory than in a wet season or even in a normal season when fungous diseases are more prevalent. It is also probable that in the presence of a greater amount of moisture the copper-arsenic dust would be changed into a sort of Bordeaux mixture on the leaves and might under such conditions compare more favorably with the sulphur-arsenate dust than was the case in this unusually dry season of 1923. It is also probable that in a dry season with rather high temperature like 1923, the sulphur-arsenate dust would be more effective as a fungicide than in a cool moist season.

Any orchardist wishing to grow choice fruit should not discard his spraying outfit in favor of a dusting equipment and should not skimp in the number of the applications and quantity of spray applied. On the other hand, if orchards are on elevated slopes with good air drainage and not seriously attacked by fungous diseases, a fair grade of commercial fruit can be grown by the dust treatment. Where the water supply is not convenient and help is difficult to obtain, the dust method might be followed advantageously.

TESTS OF SODIUM HYPOCHLORITE FOR CONTROL OF AMERICAN FOUL BROOD OF BEES.

BY PHILIP GARMAN.

Two different substances have been advertised recently as cures for bee diseases. Sodium hypochlorite solution sold under the trade name of "Be-Helth" was recommended so highly for this purpose that it was given a trial.

Sodium hypochlorite (NaOCl) is an electrolized salt, the disinfectant property of which depends upon the ease with which it gives up its oxygen to oxidizable organic matter. After oxidation, sodium chloride (NaCl) is left, and this being ordinary salt is harmless to bees. Sodium hypochlorite is used in the dairy industry for sterilizing milk pails, etc., and it is also the principal constituent of Dakin solution used in treatment of wounds during the recent war. It is a product costing a few cents a gallon to manufacture according to various chemists. Its bleaching action is quite marked, being similar in this respect to calcium hypochlorite or bleaching powder. It is also the principal constituent of "Labarraque solution" used by scientists for many years in dissolving or softening chitin contained in the hard parts of insects. This dissolving and bleaching action make it theoretically ideal for use against bee diseases where it is necessary to dissolve dead scales and penetrate masses of diseased tissue.

Four frames of brood badly diseased with American foul brood were obtained from our inspectors, Messrs. Yates and Coley, during the summer of 1923. Three of these combs were removed from the frames and the frames sterilized by spraying with a concentrated solution of "Be-Helth". The fourth comb was not removed from its frame, but was sterilized by soaking for 24 hours in the concentrated solution. It required nearly three-fourths of a gallon for this purpose, but special care was taken to fill every cell with the material. For experimental purposes two three-frame nuclei were used and one disease-free ten-frame hive of Italian bees. In one of the nuclei, two of the sterilized frames with new foundation were placed together with a healthy frame of brood from another hive. The fourth frame with new foundation was placed direct in a ten-frame hive known to be free of disease. All this was done July 17, 1923.

Examination of the two nuclei and the ten-frame hive on August 9 showed one queen cell (in the nucleus containing treated brood comb) with typical American foul brood. No sign of the disease was seen elsewhere.

Examination August 29 showed American foul brood in every frame of the nucleus containing the supposedly sterile brood comb. None was, however, found in hive or nucleus containing brood frames only. The nucleus containing foul brood was destroyed

and close watch kept upon all other treated colonies, but no disease developed in any other place.

While no definite conclusions can be drawn from the results obtained, they indicate the risk involved in attempting control in comb actually containing American foul brood. The manufacturers no longer recommend its use for that purpose, in fact, but are advocating sterilization of super combs and hive equipment for which it may be successful as indicated by our experience with infected frames without comb. The greatest difficulty lies in the extreme thoroughness with which the work must be done to insure success. Thus even with the greatest care it is almost impossible to reach all parts of a comb with sufficient solution to kill the organism. It has been demonstrated by White[1] that the spores of *Bacillus larvae* causing American foul brood are very resistant to chemical disinfectants, and this together with the information above should make one cautious about placing too much confidence in the use of the material.

ANALYSIS of "BE-HELTH"[2]

	Grams per 100 cc.
Available chlorine	3.77
Total chlorine	3.81
Sodium hypochlorite	3.96
Sulphates	Trace.

Available chlorine was determined 33 days after the first analysis and was found to be 3.70 grams per 100 cc.

FURTHER EXPERIENCE WITH PARADICHLOROBENZENE AS A REMEDY FOR PEACH BORERS.

BY M. P. ZAPPE.

For several years this material has been recommended and used to destroy the larvae of the peach borer, *Synanthedon exitiosa* Say. When applied properly, good control is obtained, and it takes less time to make the application than it does to "worm" the trees.

Usually it is customary to clear the ground of weeds and rubbish near the base of the tree, then sprinkle about an ounce of the granular paradichlorobenzene in a circle around the base of the trunk and about an inch from the bark and not touching it. Soil free from rubbish is then banked around the tree covering the insecticide and packed closely against the bark.

The first test of this material was made at the Station Farm at Mount Carmel in September, 1921, and the results published in the

[1] White, G. F. American Foul Brood. U. S. D. A., Bureau of Entomology, Bulletin 809; 1920.

[2] Made by the Department of Chemistry, Connecticut Agricultural Experiment Station.

Report of the Station for 1922, page 331. In the fall of 1922, another application was made. These trees had then been set 11 years. There were five rows of peach trees with 30 trees in each row. Four rows were treated and one row was left untreated for a check. The material was applied October 4 and 5, and was allowed to remain until the following spring without being uncovered.

On June 14, all trees were carefully examined and records kept of all borers found. The results appear in the following table:

			Living Borers		Dead Borers	
	No. of Trees	Total No. of Borers	Above Soil	Below Soil	Above Soil	Below Soil
Treated	107	71	23	0	7	41
Untreated	21	42	34	7	1	0

The results show that all borers below the surface of the soil were killed by the treatment, and that the only ones remaining alive were those above the surface of the soil where the fumes of the paradichlorobenzene could not affect them. A few dead borers were found above the surface of the soil, but probably their burrows opened below the soil surface so that they were penetrated by the fumes. In the untreated row only one dead borer was found and that was above the soil surface.

THE EUROPEAN CORN BORER IN CONNECTICUT.

Pyrausta nubilalis Hubn.

This destructive introduced pest, first discovered in this country in eastern Massachusetts in 1917, has continued to spread in that locality until the infestation involves fully half of Massachusetts, southwestern Maine, southern New Hampshire and a large portion of Rhode Island. The pest is also present in two large areas in New York State, one around Albany and Schenectady, which has spread into two towns in southwestern Vermont, and the other in western New York, this latter area extending along the southern shore of Lake Erie through the lake portions of Pennsylvania, Ohio, a few towns in Michigan and a large area in Ontario. According to the understanding of the writer these infestations around Lake Erie are all connected.

It has been expected that the margin of the Massachusetts infestation would soon extend far enough to reach the northeastern corner of Connecticut, but though Federal scouts have searched for it in Thompson and Putnam, during September, they did not find it. On the other hand, late in the fall of 1923, Federal scouts discovered three small separate infestations along the shore region of Connecticut, two in Groton and one in Niantic in the town of East Lyme.

Federal and State Quarantines.

On account of the danger of transportating this pest in shipments of vegetables other than corn, the State quarantine was revised, effective June 1, 1923, and the quarantine order with explanations was published as Bulletin of Immediate Information No. 25, and distributed under date of May 28, 1923. This publication is reproduced in the following pages.

European Corn Borer Quarantine.

The European Corn Borer, *Pyrausta nubilalis* Hubner, which was first discovered in Massachusetts in 1917, and which has since spread throughout the eastern portion of that State and into Maine, New Hampshire and Rhode Island, now menaces Connecticut and may at any time appear within its borders, especially as the margin of the present infested area is only a few miles distant from the northeastern corner of Connecticut. In addition to the infested territory mentioned above, there is a separate infestation in the vicinity of Albany, N. Y., and another in western New York extending along the shore of Lake Erie, through Pennsylvania, Ohio, and into Michigan, connecting with an infested region in southern Ontario.

The pest is believed to have first entered the United States and Canada in broom corn imported from Europe and distributed at at least three and perhaps more different points. As the pest is now known to attack a large number of different kinds of plants including common vegetables which are shipped long distances, there is great danger that this insect may be transported and new colonies formed in this manner. Though the natural spread of the insect is several miles each season, it may be carried hundreds or even thousands of miles in commercial shipments. Hence quarantines have been established to prevent these commercial jumps. Connecticut first established a quarantine against this insect on September 20, 1918, and revised it on June 1, 1920. As there is much new infested territory not covered in the former quarantine, a new quarantine order has just been issued, effective June 1, 1923. This order follows:

STATE OF CONNECTICUT

Office of
Agricultural Experiment Station
New Haven, Conn.

QUARANTINE ORDER No. 5.

Effective June 1, 1923.

Whereas a very destructive insect, known as the European Corn Borer, *Pyrausta nubilalis* Hubner, exists in certain portions of the

States of Maine, New Hampshire, Massachusetts, Rhode Island, New York, Pennsylvania, Ohio and Michigan, and threatens the corn growing industry of the country; and whereas there is grave danger that this insect may be brought into this State by the transportation of infested plants or parts of plants from the infested area:

Therefore, pursuant to the provisions of Section 2106 of the General Statutes, it is hereby ordered that no corn on the ear, stover, or other parts of the corn plant, broom corn, including all the parts of the stalk, all sorghums, sudan grass, celery, green beans in the pod, beets with tops, spinach, rhubarb, oat and rye straw as such or when used in packing, cut flowers or entire plants of chrysanthemum, aster, cosmos, zinnia, hollyhock, and cut flowers or entire plants of gladiolus, and dahlia, except the bulbs thereof, without stems, shall enter Connecticut from the infested areas mentioned below, unless each shipment, car, box, bale, or package bear a valid certificate issued by an authorized Federal inspector, stating that the contents thereof have been examined and found free from infestation by the European Corn Borer. These restrictions do not apply to dry shelled kernels or cooked and preserved products, or products grown in non-infested territory passing through infested areas in transit.

Infested Areas.

Maine: Sebago in *Cumberland County;* Acton, Alfred, Berwick, Biddeford, Buxton, Cornish, Dayton, Eliot, Hollis, Kennebunk, Kennebunkport, Kittery, Lebanon, Limerick, Limington, Lyman, Newfield, North Berwick, Old Orchard, Parsonfield, Saco, Sanford, Shapleigh, South Berwick, Waterboro, Wells and York in *York County.*

New Hampshire: Alton, Barnstead, Belmont, Center Harbor, Gilford, Gilmanton, Laconia, Merideth, New Hampton, Sanbornton and Tilton in *Belknap County;* Brookfield, Effingham, Moultonboro, Ossipee, Tuftonboro, Wakefield and Wolfeboro in *Carroll County;* Alexandria, Ashland, Bridgewater, Bristol, Groton, Hebron, Holderness, Orange and Plymouth in *Grafton County;* Amherst, Antrim, Bedford, Bennington, Brookline, Deering, Francestown, Goffstown, Greenfield, Greenville, Hancock, Hillsborough, Hollis, Hudson, Litchfield, Lyndeboro, Manchester, Mason, Merrimack, Milford, Mount Vernon, Nashua, New Boston, New Ipswich, Pelham, Peterboro, Sharon, Temple, Weare, Wilton and Windsor in *Hillsborough County;* Allenstown, Andover, Boscawen, Bow, Bradford, Canterbury, Chichester, Concord, Danbury, Dunbarton, Epsom, Franklin, Henniker, Hill, Hooksett, Hopkinton, Loudon, Newbury, New London, Northfield, Pembroke, Pittsfield, Salisbury, Sutton, Warner, Webster and Wilmot in *Merrimack County;* Atkinson, Auburn, Brentwood, Candia,

Chester, Danville, Deerfield, Derry, East Kingston, Epping, Exeter, Fremont, Greenland, Hamstead, Hampton, Hampton Falls Kensington, Kingston, Londonderry, New Castle, Newington, Newton, New Market, Northampton, Northwood, Nottingham, Plaistow, Portsmouth, Raymond, Rye, Salem, Sandown, Seabrook, South Hampton, South Newmarket, Stratham and Windham in *Rockingham County;* Barrington, Dover, Durham, Farmington, Lee, Madbury, Middleton, Milton, New Durham, Rochester, Rollinsford, Somersworth and Strafford in *Strafford County.*

Massachusetts: Barnstable, Bourne, Brewster, Chatham, Dennis, Eastham, Falmouth, Harwich, Orleans, Provincetown, Sandwich, Truro, Wellfleet and Yarmouth in *Barnstable County;* Acushnet, Attleboro, Berkley, Dartmouth, Dighton, Easton, Fairhaven, Fall River, Freetown, Mansfield, New Bedford, North Attleboro, Norton, Raynham, Rehoboth, Seekonk, Somerset, Swansea, Taunton and Westport in *Bristol County;* Amesbury, Andover, Beverly, Boxford, Danvers, Essex, Georgetown, Gloucester, Groveland, Hamilton, Haverhill, Ipswich, Lawrence, Lynn, Lynnfield, Manchester, Marblehead, Merrimac, Methuen, Middleton, Nahant, Newbury, Newburyport, North Andover, Peabody, Rockport, Rowley, Salem, Salisbury, Saugus, Swampscott, Topsfield, Wenham and West Newbury in *Essex County;* Acton, Arlington, Ashby, Ashland, Ayer, Bedford Belmont, Billerica, Boxboro, Burlington, Cambridge, Carlisle, Chelmsford, Concord, Dracut, Dunstable, Everett, Framingham, Groton, Holliston, Hopkinton, Hudson, Lexington, Lincoln, Littleton, Lowell, Malden, Marlboro, Maynard, Medford, Melrose, Natick, Newton, North Reading, Pepperell, Reading, Sherborn, Shirley, Somerville, Stoneham, Stow, Sudbury, Tewksbury, Townsend, Tyngsboro, Wakefield, Waltham, Watertown, Wayland, Westford, Weston, Wilmington, Winchester and Woburn in *Middlesex County;* Avon, Bellingham, Braintree, Brookline, Canton, Cohasset, Dedham, Dover, Foxboro, Franklin, Holbrook, Hopedale, Medfield, Medway, Millis, Milton, Needham, Norfolk, Norwood, Plainville, Quincy, Randolph, Sharon, Stoughton, Walpole, Wellesley, Westwood, Weymouth and Wrentham in *Norfolk County;* Abington, Bridgewater, Brockton, Carver, Duxbury, East Bridgewater, Halifax, Hanover, Hanson, Hingham, Hull, Kingston, Lakeville, Marion, Marshfield, Mattapoisett, Middleboro, Norwell, Pembroke, Plymouth, Plympton, Rochester, Rockland, Scituate, Wareham, West Bridgewater and Whitman in *Plymouth County;* Boston, Chelsea, Revere, and Winthrop in *Suffolk County;* Ashburnham, Berlin, Blackstone, Bolton, Boylston, Clinton, Douglass, Fitchburg, Gardner, Grafton, Harvard, Holden, Hubbardston, Lancaster, Leominster, Lunenburg, Mendon, Milford, Millbury, Northboro, Northbridge, Princeton, Rutland, Shrewsbury, Southboro, Sterling, Sutton, Upton, Uxbridge, Westboro, West Boylston, Westminster and Worcester in *Worcester County.*

Rhode Island: Barrington, Bristol and Warren in *Bristol County;* Little Compton, Middletown, Newport, Portsmouth and Tiverton in *Newport County;* Cumberland, East Providence, Lincoln, North Providence, Pawtucket, Providence and Woonsocket in *Providence County.*

New York (Eastern): Albany, Berne, Bethlehem, Cohoes, Colonie, Coeymans, Guilderland, Knox, New Scotland, Rensselaerville and Westerloo in *Albany County;* Bleecker, Broadalbin, Caroga, Ephratah, Johnstown, Mayfield, Northampton and Perth in *Fulton County;* Coxsackie, Greenville and New Baltimore in *Greene County;* Benson, Hope, Lake Pleasant and Wells in *Hamilton County;* Amsterdam, Canajoharie, Charleston, Florida, Glen, Minden, Mohawk, Palatine, Root and St. Johnsville in *Montgomery County;* Cherry Valley in *Otsego County;* Brunswick, East Greenbush, Grafton, Hoosick, North Greenbush, Petersboro, Pittstown, Poestenkill, Sand Lake, Schaghticoke and Troy in *Rensselaer County;* Ballston, Charlton, Clifton Park, Corinth, Day, Edinburg, Galway, Greenfield, Hadley, Half Moon, Malta, Milton, Moreau, Northumberland, Providence, Saratoga, Saratoga Springs, Stillwater and Wilton in *Saratoga County;* Duanesburg, Glenville, Niskayuna, Princetown, Rotterdam and Schenectady in *Schenectady County;* Carlisle, Cobleskill, Esperance, Fulton, Middleburg, Schoharie and Wright in *Schoharie County;* Luzerne in *Warren County;* Cambridge, Easton, Fort Edward, Greenwich, Hebron, Jackson and White Creek in *Washington County.*

(Western): Ashford, Dayton, East Otto, Ellicottville, Franklinville, Freedom, Leon, Little Valley, Machais, Mansfield, Napoli, New Albion, Otto, Perrysburg, Persia, Salamanca and Yorkshire in *Cattaraugus County;* Arkwright, Charlotte, Chautauqua, Cherry Creek, Clymer, Dunkirk, Ellery, Ellicott, Ellington, French Creek, Gerry, Hanover, Harmony, Mina, Pomfret, Portland, Ripley, Sheridan, Sherman, Stockton, Villenova and Westfield in *Chautauqua County;* Alden, Amherst, Aurora, Boston, Brant, Buffalo, Cheektowaga, Clarence, Colden, Collins, Concord, East Hamburg, Eden, Elma, Evans, Grand Island, Hamburg, Holland, Lancaster, Marilla, Newstead, North Collins, Sardina, Tonawanda, Wales and West Seneca in *Erie County;* Alabama, Batavia, Darien, Pembroke and Stafford in *Genesee County;* Cambria, Hartland, Lewiston, Lockport, Newfane, Niagara, Pendleton, Porter, Royalton, Somerset, Wheatfield and Wilson in *Niagara County;* Arcade, Attica, Bennington, Eagle, Gainsville, Java, Middlebury, Orangeville, Perry, Sheldon, Warsaw and Wethersfield in *Wyoming County.*

Pennsylvania: Beaver in *Crawford County;* Amity, Conneaut, Corry, Elk Creek, Fairview, Franklin, Girard, Greene, Greenfield, Harbor Creek, Leboeuf, McKean, Mill Creek, North East, Presque

Island Peninisula, Springfield, Summit, Venango, Washington, Waterford and Wayne in *Erie County*.

Ohio: Ashtabula, Austinburg, Conneaut, Denmark, Geneva, Harpersfield, Jefferson, Kingsville, Monroe, Pierpont, Plymouth, Saybrook and Sheffield in *Ashtabula County;* Cleveland, Dover, Euclid, Independence, Mayfield, Middleburg, Newburg, Rockport, Warrensville and West Park in *Cuyahoga County;* Berlin, Huron, Kelleys Island, Margaretta, Perkins, Portland, and Vermillion in *Erie County;* Chardon, Chester and Thompson in *Geauga County;* Concord, Kirtland, Leroy, Madison, Mentor, Painesville, Perry, and Willoughby in *Lake County;* Amherst, Avon, Avon Lake, Black River, Brownhelm, Elyria and Sheffield in *Lorain County;* Jerusalem, Oregon, Toledo and Washington in *Lucas County;* Allen, Bay, Benton, Carroll, Catawba Island, Clay, Danbury, Erie, Middle Bass Island, North Bass Island, Portage and South Bass Island in *Ottawa County;* Townsend in *Sandusky County;* Lake and Ross in *Wood County*.

Michigan: Bedford, Berlin, Erie, Exeter, Frenchtown, Ida, La Salle, Monroe and Whiteford in *Monroe County;* Brownstown, Detroit, Ecorse, Gratiot, Greenfield, Grosse Pointe, Hamtramck, Huron, Monguagon and Springwells in *Wayne County*.

The regulations of this quarantine order are subject to modification to include additional territory, if such is found infested and in general will be interpreted as conforming to, rather than as being at variance with, the regulations of the Federal Horticultural Board.

Quarantine Orders No. 1 relating to this insect, and issued September 20, 1918, and No. 3, issued June 1, 1920, are hereby revoked.

This order shall take effect June 1, 1923.

E. H. JENKINS,
Director, Connecticut Agricultural Experiment Station.

Approved:
CHAS. A. TEMPLETON,
Governor.

PREVALENCE OF ORIENTAL PEACH MOTH.

Laspeyresia molesta Busck

The reappearance of the Oriental peach moth in Connecticut in 1922 and 1923 has already been mentioned on page 232 of this Report. The first information regarding the presence of this pest in Connecticut was received in 1917, when specimens were sent to the Bureau of Entomology by Mr. C. C. Lawrence of the F. A. Bartlett Tree Expert Company of Stamford, and identified as the Oriental peach moth. Mr. Lawrence also sent material to this

Station, but it was badly crushed and could not be properly identified. In the absence of the writer, Mr. Quincy S. Lowry, then Assistant Entomologist, answered the letter and suggested that more material be sent for examination. Meanwhile the reply from Washington specifically identified the insect, and a short report of the pest was included in the Report of this Station for 1917, page 315. Beginning April 1, 1918, Mr. Ernest D. Brown was employed by the Federal Bureau of Entomology to search for this pest in Connecticut in order to ascertain its exact distribution. Mr. Brown worked in Connecticut for six months and found the larvae of this insect only in Stamford where it was discovered in 1917, although he found twig injury in each of the four southern or shore counties of the State. He did not find this injury far inland or in the northern counties, nor was he certain that it was wholly caused by *Laspeyresia molesta*, because the peach twig borer, *Anarsia lineatella* Zell., causes similar injury and is also present in the shore region of the State. An account of the Oriental peach moth with a report on the scouting done by Mr. Brown was published in the Report of this Station for 1918, page 298, and following this article in the same Report (page 306) is an account of the peach twig-borer, *Anarsia lineatella*, giving its distribution in Connecticut based upon the collecting done by Mr. Brown.

In 1919 and 1920, visits were made to the locality in Stamford where larvae occurred in 1918, but no signs of this insect could be found. Injury caused by it was not observed anywhere in the State in 1921, though entomologists from this office traveled about the State and were on the lookout for it.

During the autumn of 1922, considerable twig injury was noticed in the southwestern corner of the State, which was thought to have been caused by the Oriental peach moth. In the summer of 1923, twig injury was noticed in a number of orchards, and later during the annual inspection of nurseries in August and September, twig injury was found on peach stock in a few of the nurseries in Fairfield County, and on some orchard trees near the nursery stock. Perhaps the most serious attack observed was in the peach orchards at Conyers Farm, Greenwich, which the writer visited in company with Dr. Garman on June 25. Many of the new shoots were brown and had been tunneled by the larvae, though in most of them no larvae could be found. During December, Mr. A. T. Henry informed the writer that he observed considerable twig injury in his orchard at Wallingford, and on January 8, 1924, Mr. Arthur J. Watrous of Meriden, brought to the Station several peach twigs which had been tunneled by this insect during the growing season of 1923. Recently reports have been received from the orchard of Elijah Rogers and Son of Southington, indicating that this insect has injured some twigs there.

The latter part of the summer the larvae were found in fruit at Conyers Farm, Greenwich, where the manager estimates that fully

50 per cent. of the fruit was injured by the larvae, causing a money loss of at least $5,000.00 in damage to crop, not to mention injury to reputation on account of having wormy fruit. The late varieties such as Hale, Elberta and Belle of Georgia were damaged more than those varieties ripening earlier in the season. A number of infested peaches were observed at the Station Farm, Mount Carmel, and Mr. Watrous also reported that he found infested peaches in his orchard in Meriden.

According to fruit growers and entomologists, this pest caused serious damage in 1923 in Pennsylvania and in New Jersey, where in some cases 80 per cent. of the late peaches were infested.

Though the larvae attack apples and other fruits in the Middle Atlantic States, only peaches have been found infested by it in Connecticut.

Summary of Life History.

The eggs of the first brood are probably laid the latter part of May or early in June on the under surface of the leaves. They are laid singly and hatch in four to seven days; the larvae go to the new shoots and tunnel in them, causing them to turn brown at the tips as is shown on Plate XVIII. They often leave one shoot and enter another, and this explains why injured empty shoots are so abundant in a badly infested orchard. It is not known how many generations occur in Connecticut, but in Maryland, Dr. Garman[1] found four generations, only about 26 days being required for the entire life cycle. Wood and Selkregg[2] found a partial fifth generation near Washington, D. C., but Stearns[3] found only four broods in Virginia. In Maryland the first two broods were fairly distinct, but the third and fourth overlapped so that it was hard to separate them. In New Jersey according to Dr. Peterson, the last three broods overlap.

As the season advances and the new growth hardens and becomes woody twigs, the larvae attack the fruit. In late summer the newly hatched larvae apparently go directly into the fruit, and often several larvae are found in one peach. The larva has the habit of biting into the tissues and laying aside the first few mouthfuls, then eating its way into the twig or fruit. For this reason the larvae cannot be controlled satisfactorily by applications of arsenical poisons.

The larval period averages about eleven days and the pupa stage lasts about ten days. When mature the larva eats out cavities in the sides of twigs or whatever surface is near at hand and suitable for the purpose, and there makes an inconspicuous cocoon. Those maturing late in the season usually enter crevices of the bark

[1] Bulletin 223, Maryland Agricultural Experiment Station, page 113, 1917.
[2] Journal of Agricultural Research, vol. XIII, page 63, 1918.
[3] Technical Bulletin 21, Virginia Agricultural Experiment Station, 1921.

at the base of the trunk or in similar situations higher up on the tree and are very difficult to detect. The hibernating larvae pupate in these cases in the spring, and the moths soon emerge to lay eggs for the first brood of larvae.

Altogether some 15 different parasites of the Oriental peach moth have been reared in the United States. Of these 12 belong to the Hymenoptera and three to the Diptera. In Dr. Garman's studies in Maryland[1] two important parasites were obtained. One, a Braconid, *Macrocentrus* sp., was reared in small numbers from the larvae, and the other, a Chalcidid, *Trichogramma minutum* Riley, parasitized about 80 per cent. of the eggs. Wood and Selkregg[2] recorded six primary parasites belonging to the Hymenoptera and one belonging to the Diptera.

Professor E. N. Cory, State Entomologist of Maryland, estimates that about 60 per cent. of the larvae and about 50 per cent. of the pupae are parasitized in Maryland. Stearns[3] reports that on the average only 20 per cent. of the larvae of the three summer broods were parasitized in Virginia in 1920, and fully 85 per cent. of the hibernating larvae came through successfully.

Control Measures.

The Oriental peach moth is a difficult pest to control. Many tests have been made with various liquids and gases to kill the over-wintering larvae in their cases, but these cocoons or cases are almost impenetrable, so the larvae for the most part pass through the treatment uninjured.

After pruning the orchard, it is advisable to burn all twigs for this may destroy some of the hibernating larvae.

Stearns[1] finds that spraying with nicotine solution diluted at the rate of one part in 500 parts of water, will kill the eggs in Virginia[4]. A caseinate spreader at the rate of two pounds in 50 gallons of mixture increased the effectiveness of the treatment. Only 4.7 per cent. of the untreated eggs failed to hatch, whereas from 75 to 85 per cent. were killed by the treatment.

The approximate periods of heaviest egg-laying in Virginia were from May 8 to 16 for the first brood, from May 31 to June 7 for the second brood, and from June 27 to 29 for the third brood and from August 1 to 10 for the fourth brood. The spray treatments should be given with reference to these dates. Egg-laying dates have not been ascertained for Connecticut.

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[1] Bulletin 209, Maryland Agricultural Experiment Station, 1917.
[2] Journal of Agricultural Research, Vol. XIII, page 70, 1918.
[3] Journal of Economic Entomology, Vol. 14, page 337, 1921.
[4] Journal of Economic Entomology, Vol. 14, page 340, 1921.

THE LARCH LEAF-MINER OR CASE BEARER.

Coleophora laricella Hubn.

On June 4, Mr. H. W. Hicock, Assistant Forester, brought to the laboratory from the town of Canaan, branches of larch which had been attacked by the larch leaf-miner or case bearer, *Coleophora laricella* Hubn. The newly formed leaves had been mined and injured to such an extent that the foliage of the entire branch had a gray appearance and later turned brown. According to Mr. Hicock, the specimens came from a large swamp a mile or so in extent, and the trees were distinctly brown on the day of his visit. This swamp is situated near the road connecting Canaan with South Canaan. Injured foliage is shown on Plate XIX, a.

On June 7, larch received from New Canaan also showed the attacks of this insect. The writer noticed slight injury to larch trees on private grounds and in public parks in New Haven and various other parts of the State. Never before in recent years has this insect been so abundant in Connecticut.

The larch case bearer is a European insect and on the continent it has caused damage to the larch trees of the forests, particularly in Germany. When the larch was introduced into the British Isles, this case bearer soon appeared in England and Scotland. Later it made its appearance in America and probably was brought across the Atlantic on nursery stock. It has been reported from Canada and the northeastern United States.

Injury to the Trees.

The young larva is a leaf-miner at first and tunnels the distal half of the needle. It cleans out this hollow needle and then cuts it off at the base of the excavated portion and uses the latter as a case, carrying it about when feeding, and resting in it much like the cigar case bearer, *Coleophora fletcherella* Fern., and other case bearers. The appearance of this case is shown on Plate XIX, b. As the partly grown larvae pass the winter in these cases on the twigs, they are ready to resume feeding on the first leaves that are put out in the spring. Consequently when the larvae are abundant the leaves are eaten about as fast as they can grow, with the result that the trees look sickly and brown by the first of June, instead of green and vigorous. Even though more leaves are put out, they are mined later in the season. Thus severe attacks weaken the trees, and Dr. Patch[10] writes as follows: "The injured needles often continue to grow but the clusters are ragged and many of the needles brown and dry. Small larches in the vicinity of Bangor and Orono which have been subjected to an attack of at least three seasons, died this summer from no other apparent cause than the presence of great numbers of the case bearers which kept the needles eaten off. Many large larches infested by this insect look yellowish and unhealthy."

Life History and Habits.

The eggs are laid upon the leaves during the first part of June and on hatching, each larva bores directly through the bottom of its shell and into the tissues of the leaf, where it continues to burrow, usually tunneling out the distal half. It has the habit of packing its excrement into the burrow in the mined leaf. By September the leaf has been completely mined, and the larva being small and only partly grown, cuts off the distal portion of the leaf; then it cleans out the excrement from the basal portion and uses this for its winter case. Sometimes it goes into a new leaf and sometimes makes its case of old leaves. The inside of each case is lined with a thin layer of silk. The larvae continue to feed for three or four weeks after making their winter cases, then fasten them with silk to the branches and twigs where they remain throughout the winter, as shown on Plate XIX, b. The outer end of the case is closed with silk and somewhat contracted. Usually this migration to the twigs occurs in October, and they remain there for about six months.

On the approach of warm weather, usually in April, the larvae dislodge their cases from the branches and migrate to the buds, where they are ready to partake of their first meal after their long winter fast. As soon as the new leaves are of sufficient size they fasten their cases to them or use them to enlarge their cases. This is fully described by Herrick[8] who states that this is the period when the insect does its greatest amount of damage, for each larva may feed upon more than one leaf, and being larger, destroys more leaves than before hibernation. The larvae continue to live in these enlarged cases and pupate in them in May, attaching themselves at the base of short side branches and in the center of leaf whorls.

The pupa stage lasts from 14 to 20 days and the adult moths emerge the last of May and following. The moths are active during the day and when at rest, the wings are folded closely over the body, and the antennae are extended forward.

Apparently there is only one generation each year, as is usual with most other case bearers.

Description.

Egg.—Eggs though small are visible without a magnifying glass. They are reddish-brown in color, nearly hemispherical in shape with 12 to 14 radiating ridges extending down the sides from the apex.

Larva.—Length, about five mm. when fully grown, dark reddish-brown, head, thoracic and anal shields, black.

Adult.—Wing expanse about nine mm., silvery grayish-brown or ash-gray in color, both front and rear wings narrow and bear

long fringe, characteristic of the family Elachistidae to which this species belongs.

Natural Enemies.

Herrick[8] bred three species of parasites in New York but only in small numbers; these were identified only provisionally on account of a lack of material. One belonged in the genus *Pachyneuron*, one to the Pteromalidae, and one to the Tetrastichidae. He reports that nine parasites have been recorded from Europe.

Control Measures.

There is no practical method of controlling this insect in forests or large plantations, but on shade and ornamental trees and in small plantations on private estates where cost is not an important matter, some attempt at control is feasible.

The most extensive experiments of which we have record are those conducted by Professor G. W. Herrick[8] in Ithaca, New York, in 1911. Trees sprayed with lead arsenate April 25, and even given an additional treatment May 5, were just as badly injured as the trees not treated.

Home-made concentrated lime-sulphur, testing 29° Beaumé, was diluted at the rate of one to seven and the tree thoroughly coated with the mixture on April 7, before the buds had begun to swell and before the larvae had left their winter positions. This tree was badly infested. An examination on April 27 showed that the buds had started and that on unsprayed trees the larvae had moved to the leaves, but not one had moved on the sprayed tree. On May 5, many larvae were examined. Only two were found to be alive; the others were dead and shriveled. Consequently, in view of these tests, it seems advisable to spray shade and ornamental trees with lime-sulphur, as for scale, late in the spring just before the buds open.

Literature.

[1] Felt, E. P., Memoirs N. Y. State Museum, 8, page 170, 1905. (Life history and habits.)

[2] Fernald, H. T., Can. Ent., Vol. li, page 264, 1919. (Injured trees in Northampton, Mass., same spot where Hagen reported it in 1886. Describes egg and habits of young larva.)

[3] Fletcher, J., Report of the Entomologist and Botanist, Central Experimental Farms, page 191, 1905. (Brief account).

[4] Fletcher, J., Thirty-sixth Annual Report, Ontario Ent. Soc., page 90, 1905. (Reports insect in moderate numbers at Experimental Farm, Ottawa, Can., and believes this the first record for Canada.)

[5] Gibson, A., Forty-first Annual Report, Ontario Ent. Soc., page 14, 1910. (Reports insect not abundant at Ottawa until 1910.)

[6] Hagen, H. A., Canadian Entomologist, Vol. xviii, page 125, 1886. (Abundant on European larches at Northampton, Mass.)

[7] Herrick, Glenn W., Annals Ent. Soc. Am., iv, page 68, 1911. (Describes habits and partial life history: original observations, Ithaca, N. Y., 1910-1911.)
[8] Herrick, Glenn W., Cornell Agr. Expt. Station, Bulletin 322, 1912. (Complete life history, habits, natural enemies, control, bibliography.)
[9] Herrick, Glenn W., Journal of Economic Entomology, Vol. 5, page 172, 1912. (Treatment with lime-sulphur.)
[10] Patch, Edith M., Maine Agr. Expt. Station, Bulletin 134, page 218, 1906. (Brief account of habits and life history. Mentions death of trees.)
[11] Patch, Edith M., and Johannsen, O. A., Maine Agr. Expt. Station, Bulletin 195, page 239, 1912. (Mention as being abundant on American Larch in 1911.)
[12] Swaine, J. M., Forty-third Annual Report, Ontario Ent. Soc., page 88, 1912. (Mentioned as being abundant on European and American larches in Ottawa in 1912.)
[13] Theobald, F. V., Report on Economic Zoology, page 111, 1905. (Brief illustrated account.)
[14] Weiss, H. B., Ent. News, Vol. xxvii, page 424, 1916. (Not extensively distributed in N. J. Probably introduced on nursery stock.)

THE ASIATIC BEETLE.

Anomala orientalis Waterhouse.

In the Report of this Station for 1922, page 345, is a brief account of this new pest which has apparently become established in Connecticut. Since this note was prepared for publication, further developments have occurred which warrant further mention here of the undesirability of this insect.

Late in the fall of 1922, one of my neighbors, Mr. H. M. Bowman, complained to me that white grubs were injuring his lawn at 228 Alden Avenue, and on November 2, I visited his place and collected a few specimens. These grubs had killed the grass in a patch perhaps eight by ten feet in the front lawn near the sidewalk. By digging in the soil, we found some of the grubs, though Mr. Bowman stated that they had recently descended and were much nearer the surface a short time before. Evidently they had gone down for protection during the winter. These grubs were quite active and though varying considerably in size, all were rather small. Otherwise they looked like ordinary white grubs and at the time we took them to be the larvae of May or June beetles (*Phyllophaga* sp.) These grubs all died probably having injured each other with their mandibles, as we afterward learned they are apt to do when confined together with little soil. The grubs are shown on Plate XX, b.

The next spring other residents of the neighborhood complained of similar injury to lawns. Mr. Robert S. Scobie, corner of Central and Edgewood Avenues, particularly had been troubled by them and had reseeded his lawn, only to have the new grass also eaten by the grubs. Mr. William E. Woodmansee and Mr. Clarence M. Blair of Edgewood Avenue had also gone through similar experiences. An injured lawn is shown on Plate XX, c.

Mr. Scobie accommodated us on May 17 by collecting a considerable number of grubs with a good supply of dirt. These were promptly separated so that they could not injure each other, by putting only a few larvae in each of several cages and supplying them with plenty of food and soil. On July 24, adult beetles emerged and proved to be *Anomala orientalis.* Prior to the emergence of these beetles, specimens of the larvae were sent to Professor John J. Davis, Agricultural Experiment Station, LaFayette, Indiana, who had formerly been in charge of the Japanese Beetle Laboratory at Riverton, New Jersey, and prior to that had made a study of white grubs and various larvae of the beetle family Scarabaeidae. Professor Davis replied that he had sent his collection of larvae to Washington and was therefore unable to identify our material. He therefore forwarded it to Washington and in due time a report was received stating that it had been examined by Dr. A. Boving and identified provisionally as *Anomala orientalis.* Of the reared material, some specimens are light brown with very faint markings and some are black, as is the case with the native *Anomala lucicola* Fabr. Between these two extremes there are all gradations. This variation is shown on Plate XX, a.

More material was collected in the field in 1923. The adults do not fly but are found in the grass and weeds near the ground or crawling up the stems. This habit retards the dissemination of the pest and simplifies materially the problem of control. Messrs. Zappe and Garman treated small areas of infested soil in the lawns of Mr. Woodmansee with calcium cyanide compound, carbon disulphide emulsion and some other materials. The first killed the larvae and also the grass and weeds. The other materials in the proportions used were not effective in destroying the larvae.

No very thorough survey has yet been made to ascertain the present distribution of the pest. The preliminary survey shows that the injured lawns are all within five or six city squares or blocks, but as a certain number of larvae may be present per square yard without injuring the grass above ground, the distribution is probably much greater than indicated. It would be necessary to dig through the turf in thousands of places to ascertain its real distribution. Moreover as this infestation apparently was caused by nursery stock being imported with balls of earth from Japan, before the prohibition of such shipments by the Federal Horticultural Board, there is also a strong probability that this insect has likewise been sent out from the nursery to other points, perhaps nearby or far distant. This nursery has now been moved to Woodmont some six miles distant, and possibly the insect has been carried there also. The ground where the nursery formerly stood has all been sold for building lots and residences have been built upon it. In excavating for cellars and in grading, the upper soil has nearly all been moved, and this must have had some effect on the larvae in the soil. The lawns most seriously injured are

those across the street (Edgewood Avenue) from that part of the nursery where the adult beetles were first collected in 1920.

The parasite, *Scolia manilae* Ashm., which was so successful in reducing the infestation of *Anomala orientalis* in Hawaii a few years ago, has been imported into New Jersey to be used in controlling the Japanese beetle, *Popillia japonica*, but does not survive the winters there. Consequently we cannot hope for much help from this insect in controlling the infestation of *Anomala orientalis* in Connecticut, but there is a possibility that some of our native species of *Scolia* or *Tiphia* may attack the grubs.

SWARMS OF APHIDS.

During the season there were two separate swarms of aphids, one in June and the other in September, both of which should be recorded here. A similar swarm has been mentioned in the Report of this Station for 1919, page 203.

The aphids were so abundant and noticeable in and about New Haven, Bridgeport and Waterbury in June, 1923, that the newspapers printed notes regarding the matter. The following account of the June flight was published in the Journal of Economic Entomology, Vol. 16, page 395, August, 1923:

Swarms of Aphids: During the week ending June 9, newspapers and telephone inquiries reported that swarms of aphids were present in the cities of Meriden and Waterbury, Conn., and on June 8, specimens were received from Waterbury. On June 8, Mr. Zappe collected specimens at his home, Mount Carmel, where they were so abundant in the air that his little daughter said to him: "Daddy, it's snowing". During the week ending June 16, similar swarms of aphids appeared in the center of the city of New Haven, and the writer observed them on Elm Street on the afternoon of June 16. The tops of automobiles and clothes were literally covered with aphids and pedestrians were brushing them from their faces. Mr. Rogers of this Department states that in Bridgeport swarms of aphids have been present for three weeks, and one day in the city in catching a butterfly he also caught two or three hundred of these aphids in the net. Even at the date of this writing (July 3) aphids have not all disappeared in New Haven, and this morning Mr. Rogers ran into a swarm on Winchester Avenue. It is not certain that all of these aphids were of the same species, but those examined seemed to be identical and material submitted to Dr. A. C. Baker of the Bureau of Entomology has been identified as *Euceraphis deducta* Baker, a species described from Maine in 1917 (Journal of Economic Entomology, Vol. X, page 427). Birch is the host of this species and the swarms probably came from *Betula populifolia*, which is abundant around all of these Connecticut cities. In 1919, I recorded the presence of swarms of *Calaphis betulaecolens* Fitch

(see Journal of Economic Entomology, Vol. 12, page 351) in New Haven, Conn., and at first I supposed the swarms of the present season were of that species. A microscopic examination, however, showed them to be different. Dr. Baker writes that "it is very interesting that this recently described species should become so abundant".

This species, *Euceraphis deducta* Baker, had somewhat the aspect of a woolly aphid. That is, each individual bore some wax secretion in the nature of white filaments.

From September 19 to 25, aphids were again swarming in the streets of New Haven, and it was several days or perhaps weeks before they entirely disappeared. Specimens collected showed this to be *Calaphis betulaecolens* Fitch, a species devoid of the white wax filaments, and the same species observed in the city in 1919.

Both of these species live upon the leaves of birch trees, and it is not known whether they have alternate hosts, but perhaps like many other kinds of aphids, they were migrating to other host plants, which explains their presence in such number in the center of large cities. Birch trees are common on the uncultivated land around the outskirts of nearly all cities of Connecticut. The species of the September swarm, *Calaphis betulaecolens* Fitch, is also recorded from linden (*Tilia*) but evidently its full life history has not been determined.

MOSQUITOES AND HUMAN WELFARE.

Mosquitoes have been known and recognized as a pest since the earliest times. Writers have mentioned them; armies have been attacked by their hordes; large military and civic operations have been abandoned because of the great abundance of mosquitoes. Today mosquitoes occur throughout the world, from the tropics to the polar regions; all countries and all climates have been preempted by them and all races have been attacked by them. Not only do they attack persons, but also the larger animals, blood being necessary for the development of their eggs.

Certain kinds of mosquitoes through their bites transmit yellow fever, other kinds carry malaria and in no other way can these diseases be communicated from one person to another, except possibly by direct inoculation.

All kinds of mosquitoes annoy mankind, prevent property development, and therefore cause a tremendous economic loss to community, state and nation. Moreover, their abundance is wholly unnecessary.

Where Do Mosquitoes Breed?

Only in stagnant water. Until they reach the winged or adult stage, they can live only in fairly still water, where they are able to

obtain air at the surface. The belief of many persons that mosquitoes breed in grass, shrubbery and vines, is wholly false, though the pests hide and rest in such places. Water is just as essential for the wrigglers (larvae and pupae) as it is for trout or codfish, and if there were no standing water, there would be no mosquito nuisance. Permanent and deep pools and streams are usually stocked with fish and do not breed mosquitoes, because the fish will eat the wrigglers, should any hatch there. Rain water pools, barrels, buckets, tin cans, bottles and clogged ditches and gutters are common breeding places for fresh water mosquitoes, and the

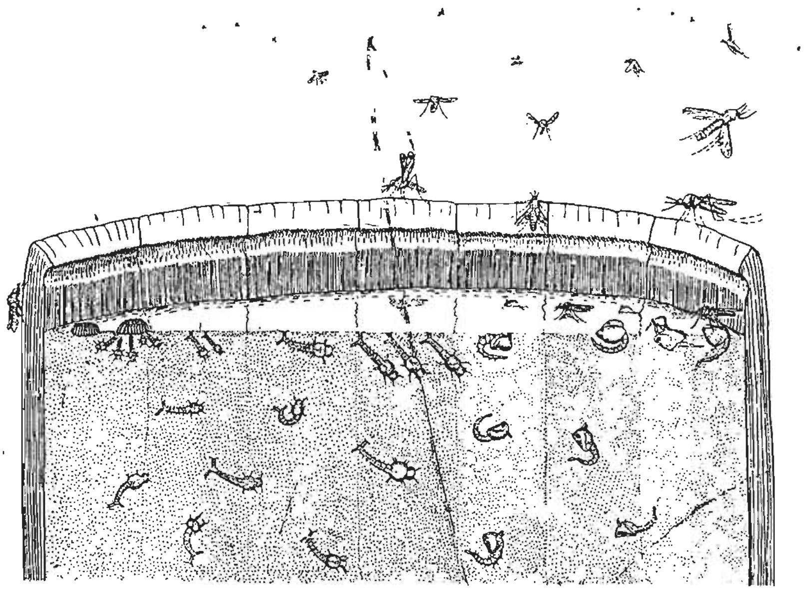

Figure 11. Section of rain barrel showing eggs, larvae and adults of the rain barrel mosquito.

shallow depressions on the salt marsh are typical breeding places for salt marsh mosquitoes.

Only the Females Bite and Sing.

Male mosquitoes are very puny creatures and are not able to puncture the human skin. They live only a short time, and make no singing or humming noise. The common sound known as the "song" of mosquitoes is made by the females which are also responsible for all the mosquito bites. They bite in order to obtain blood, without which they are unable to develop eggs.

Life History of Mosquitoes.

Most mosquitoes lay their eggs on the surface of the water, either singly or in raft-like masses which float upon the surface. On hatching, each larva drops into the water and during its larval existence swims about with a jerky motion, most of the time holding its head downward. It has a large head with a tube or siphon at the tail, and every two minutes or so it comes to the surface and inhales some fresh air through this siphon. It feeds upon the minute particles of organic matter in the water, from six days to three weeks, depending upon the temperature, when it

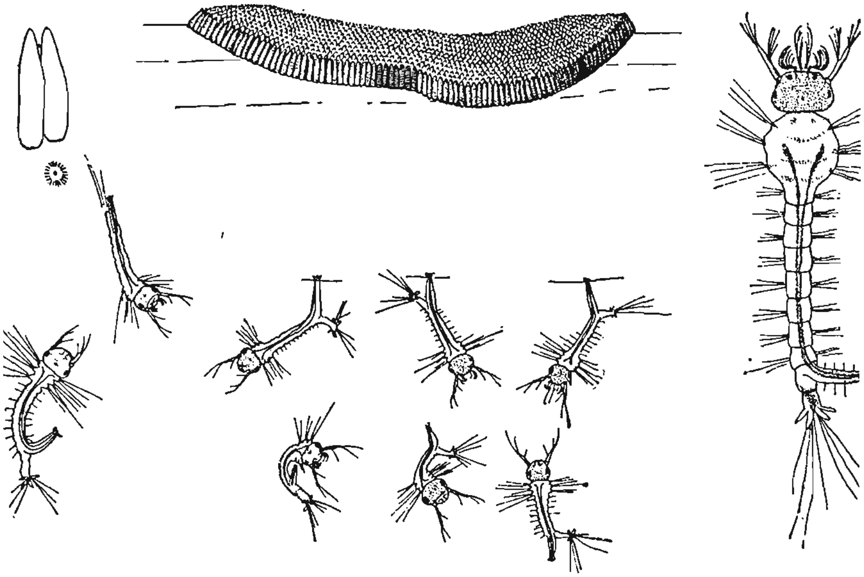

Figure 12. Eggs and young larvae of the house or rain barrel mosquito, *Culex pipiens*, Linn. All enlarged. (After Howard, Bulletin 25, Bureau of Entomology, U. S. Department of Agriculture.)

transforms to a peculiar hunchback pupa. Breathing is now done through two siphons on the thorax instead of one at the tail. In about two days the skin cracks open along the back, and the adult winged mosquito emerges, and after resting on the old shell and drying its wings, soon flies away. Only about a week is necessary for a mosquito to develop from egg to adult in hot weather. The stages in the life of a mosquito are (1) egg; (2) larva; (3) pupa; (4) adult.

Flight of Mosquitoes.

With the exception of the salt marsh mosquitoes, a few hundred feet is the extent of the distance traveled by most mosquitoes.

Salt marsh mosquitoes (two species) migrate or are wind-borne for many miles. In New Jersey they have been found at least thirty miles from their breeding place, and in Connecticut eighteen miles. During strong winds they seek shelter, but in warm foggy weather, gentle breezes may aid them in going inland for several miles. After obtaining blood, they return to the salt marsh to deposit their eggs.

Where intensive breeding takes place in polluted streams, the

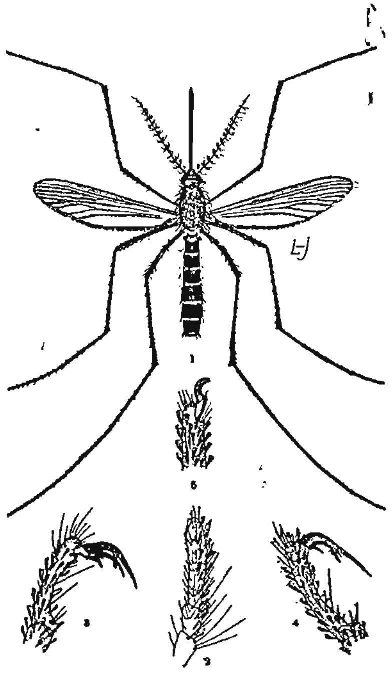

Figure 13. The house or rain-barrel mosquito, *Culex pipiens* Linn: 1. adult female; 2. palpus; 3. anterior, 4. middle, 5. posterior claws of male. All enlarged. (After Smith, Report on New Jersey Mosquitoes.)

house mosquito has been found a mile from its breeding place, but usually this species does not go more than one-fourth that distance.

Different Kinds of Mosquitoes.

There are known to be about 500 different kinds of mosquitoes throughout the world; about 100 kinds occur in the United States. Nearly 50 species have been recorded from the State of New York, and about 25 kinds occur in Connecticut. Of this number, only five kinds need here be considered.

RAIN BARREL OR HOUSE MOSQUITO 1. *Culex pipiens* SPOTTED OR MALARIAL MOSQUITO (2 species) 2. *Anopheles punctipennis* 3. *Anopheles quadrimaculatus*	Breed in fresh water; fly only short distances; enter houses and bite after dark.
SALT MARSH OR MIGRATORY MOSQUITOES 4. Brown salt marsh mosquito, *Aedes cantator* 5. White-banded salt marsh mosquito, *Aedes sollicitans*	Breed in brackish water; fly long distances; do not enter houses, and bite promptly in the day time.

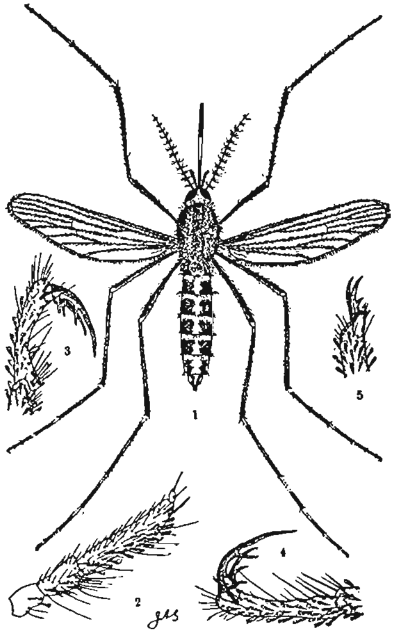

Figure 14. The banded salt marsh mosquito, *Culex sollicitans* Walk.: 1. adult female; 2. palpus; 3. anterior, 4. median and 5. posterior claws of male. All enlarged. (After Smith, Report on New Jersey Mosquitoes.)

How to Distinguish Malarial from Other Mosquitoes.

Malarial mosquitoes have spotted wings, the beak and body are nearly in a straight line, and it "stands on its head".

Other mosquitoes do not have spotted wings, the beak makes a greater angle with the axis of the body and the body is parallel with the surface upon which the mosquito stands or rests.

Larvae or wrigglers in the water may also be distinguished by their different shapes. Malarial species are green or gray, lie horizontally at the surface of the water, and move to other posi-

tions on the surface without dropping downward into the water. Moreover their bodies are nearly as thick at the tail as through the head and the breathing tube or siphon is very short. Other mosquito larvae hold their heads downward when breathing at the surface and if disturbed drop downward into the water. The head and thorax are large, from which the body tapers toward the tail end, which is furnished with a long siphon. The color is usually dirty white or gray.

THE MOSQUITO PLAGUE OF CONNECTICUT.

The great mosquito plague of Connecticut is caused by the abundance of only a few kinds of mosquitoes. A few years ago

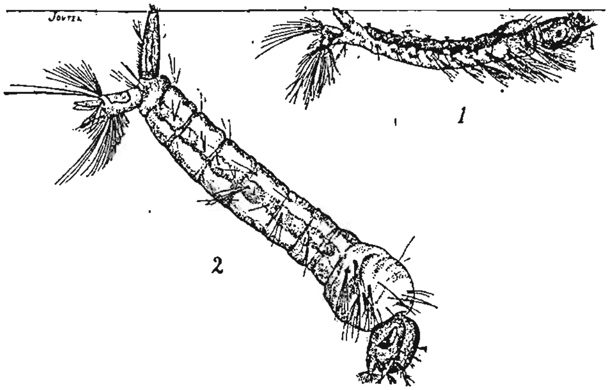

Figure 15. Larvae of *Culex* and *Anopheles*, showing the characteristic position of each at the surface of the water. 1. *Anopheles;* 2. *Culex cantator.*

in the southern half of the State, the salt marsh mosquitoes were the most prominent, and this is true today except in certain sections where the salt marshes have been ditched. In these ditched sections and in all other parts of the State, the rain barrel or house mosquito is the chief offender.

At present about one-third of all the salt marsh areas of Connecticut have been ditched and the ditches have been maintained in working condition. There still remains some 12,000 to 14,000 acres of salt marsh to be ditched before we shall be rid of the nuisance of migratory or day-biting mosquitoes.

The rain barrel mosquito is local in its distribution and breeds in rain water pools, receptacles, polluted streams, etc. A single bucket of water will furnish enough mosquitoes to infest the premises.

Control or Relief Measures.

Rain Barrel Mosquitoes.—Fill or drain all depressions which may catch or hold water during the summer months. See that no receptacles collect and hold rain water about the premises. Small swamp areas and deep depressions which cannot be filled or drained except at great expense, may be dredged to form permanent pools and stocked with fish.

Malarial Mosquitoes.—See that edges of springs and streams are cleared of vegetation and have steep banks. Screen all houses, and particularly all persons having malaria.

Salt Marsh Mosquitoes.—Cut narrow parallel ditches through the salt marsh, from the hard land to the central creek or outlet. These usually need to be about 150 feet apart, but the distance depends upon the character of the marsh and the amount of breeding. Special work, such as building dikes, tide gates and deepening major outlets are necessary in some cases. In general these narrow ditches cost about ten dollars per acre. A slight expense each year must be incurred to examine the ditches and remove obstructions.

Oiling.

Wherever mosquitoes are found breeding in water, it is possible to kill all of the wrigglers by spreading a film of oil on the surface. This prevents their access to the air and they suffocate. The oil also penetrates their respiratory system and injures their tissues. Kerosene is the cheapest oil for this purpose which is readily and universally available. Light fuel oil may be obtained from oil stations in the larger cities. Old cylinder oil from garages may be used if mixed with an equal quantity of kerosene. A spray pump is the common agency for spreading the oil, though in small pools a sprinkling can or saturated sawdust may be used. One fluid ounce of kerosene will cover about 15 square feet of surface.

Oiling is only a temporary expedient and should not be practiced except in special cases. On the salt marsh in a single season it would cost about one-fourth as much to oil the pools as it would to cut ditches, but the ditches would last for years and make further oiling unnecessary.

Mosquito Enemies.

Fish feed upon mosquito wrigglers, particularly small fish such as "minnows" and "killies" which eat animal food and feed near the surface. By cleaning the banks of deep pools and sluggish streams, and stocking with these fish no mosquitoes will breed there. There are also many aquatic insects which devour mosquito larvae.

Individual and Community Effort.

The control of the fresh water species like the malarial and rain barrel mosquitoes which fly only short distances, is a matter for each individual resident and property owner, though far more will be accomplished if all individuals work together toward the same end. This is largely a problem of house to house inspection, with control measures practiced where needed.

It is a commendable line of activity for local civic and village improvement associations, boy and girl scouts and women's clubs

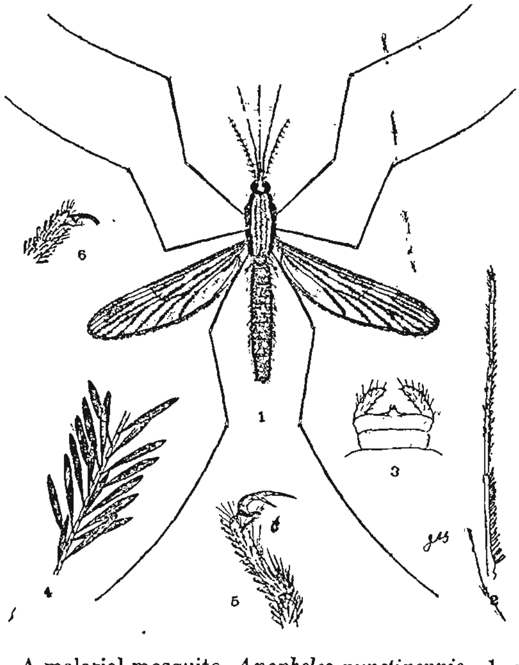

Figure 16. A malarial mosquito, *Anopheles punctipennis*. 1. adult female; 2. palpus; 3. genitalia; 4. part of wing vein, showing scales; 5. anterior, and 6. middle claws of male. All enlarged. (After Smith, Report on New Jersey Mosquitoes.)

to co-operate with the Experiment Station. Surveys can be made in each neighborhood to ascertain where mosquitoes are breeding. When mosquitoes are especially troublesome, specimens should be collected and sent to the Station for identification. There is already legislation (Section 2408 of the Revised Statutes) declaring accumulations of water in which mosquitoes breed a public nuisance, and authorizing the health officer to order them abolished.

Salt Marsh Mosquito Problem a State-Wide Matter.

As the mosquitoes of the salt marsh are migratory and often fly long distances, isolated individual or even community effort counts for but little in controlling the plague. Even efforts involving entire townships, though commendable, do not bring the maximum degree of relief unless other towns also act in the matter. Some towns will take no action, either on account of cost or because the people do not expect effective results. Consequently when left entirely to local initiative, the work is apt to be spotted and disconnected if any is done at all. Thus the salt marsh area of Connecticut has been ditched from the New York line as far eastward as Westport, which is still unditched, Fairfield, Bridgeport, a part of Stratford, West Haven, New Haven, a part of East Haven, from Branford River to Hammonasset River with small areas in Old Saybrook and Groton, have all been ditched. Some of the areas mentioned above are not yet under State supervision. In order to make the work continuous and to obtain the full benefit of the ditching already done, the towns of Westport, Stratford, Milford, parts of East Haven and Branford, Clinton, and all towns to the eastward should have their salt marshes ditched.

Legislation has already been enacted (see Section 2409 of the Revised Statutes and Chapter 68, Public Acts of 1923) providing for, and authorizing the Director of the Connecticut Agricultural Experiment Station to ditch salt and fresh marshes and maintain the same. He can make investigations and furnish estimates, supervision, etc., upon request. In case the ditching work has been accomplished, he will inspect it upon request. If it merits his approval, he will accept it officially and see that it is properly maintained at State expense.

Benefits of Mosquito Control.

Health.—Eradication of malaria bearing mosquitoes will prevent the spread of malaria in any community, town or state. Other native species of mosquitoes, though not known to carry disease-causing organisms, are a detriment to health because their bites sometimes become infected, and because of the irritating effect on the nervous system.

Comfort.—No person can be comfortable when attacked by hordes of mosquitoes. Whole regions have been developed, neglected or abandoned because of the absence or abundance of mosquitoes.

Increased Property Values.—Wherever the mosquito nuisance has been controlled, substantial increases in property values have followed. This is a logical result of making building sites more desirable because people can be more comfortable there. The increased population means increased business, increased trans-

portation, and better yet, increased taxes for the town and for the State.

Increased Crops.—Wherever salt or fresh marshes are ditched the quality of the vegetation is improved; it makes better hay. The quantity is also increased, giving a greater yield. It has been shown in New Jersey that by ditching the yield of salt marsh hay has been increased from two to twenty fold.

Send Specimens For Identification.

If anyone is interested in the mosquito problem of his locality and wishes to know whether malarial mosquitoes are present, he is requested to collect adult mosquitoes and send them for identification to the Connecticut Agricultural Experiment Station, New Haven, Conn. They should be mailed in a pill box or vial, well packed so that they will not become crushed in transit. Mosquitoes which are badly worn or broken cannot readily be identified, but if the material is fresh and plentiful (10 to 20 specimens) there should be no difficulty in identifying the species.

MOSQUITO CONTROL WORK.

Season of 1923.

By R. C. Botsford.

Legislation.

The State law providing for the elimination of mosquitoes, Chapter 21, Public Acts of 1919 (see 1919 Report, Connecticut State Entomologist, page 194) was amended by the 1923 Legislature to read as follows:

Chapter 68.

Section 1. Section 2409 of the general statutes is amended to read as follows: The director of the Connecticut Agricultural Experiment Station may make rules and orders concerning the elimination of mosquitoes and mosquito breeding places, and he or his agent may enter upon any swamp, marsh or land to ascertain if mosquitoes breed thereon or to survey, drain fill or otherwise treat, or make any excavation or structure necessary to eliminate mosquito breeding on, such land. Whenever funds have been provided by voluntary contribution or by appropriation by the state for the elimination of mosquitoes or mosquito breeding places said director may order the execution of such work upon notice as herein provided. At least thirty days before commencing such work, said director shall file a copy of such order, with a description of the place or area affected and a statement of the proposed plan thereof, in the town clerk's office in each town in which such place or area is located. Said director shall publish a copy of such order once each week for two successive weeks in some newspaper having a circulation in the town or towns in which such place or area is situated, and shall mail a copy of such notice, postage prepaid, by registered mail, addressed to each record owner of land whose name and address may be ascertained by a reasonable inquiry from the assessors of the town in which such land is situated. Said

director may, and upon application of any person affected by such order or plan, within thirty days after such publication, shall, assess damages sustained by the owner of any such land. Such assessment shall be filed by said director with the clerk of the superior court of the county within which the land affected is located, and said clerk shall give notice of such assessment to each such property owner, by mailing to him a copy of such assessment, postage prepaid. Any person claiming to be aggrieved because of such order or proposed plan or such assessment may, within ten days after notice, apply to the superior court in the county in which such land is situated, or any judge thereof, for relief, and said court or such judge may, after notice to said director and parties applying for relief, and hearing thereon, make any proper order concerning such order or proposed plan, or make a reassessment of damages. Said court or judge may view the land claimed to be affected by such order or plan and may take any evidence in his opinion material. The order, plan and assessment as hereinbefore provided for shall be conclusive upon all parties affected thereby, and the state treasurer shall pay to any such owner the damages assessed by said director or by said court or judge, as the case may be, upon certification of the amount by the clerk of said court. The pendency of any application for the assessment of damages shall not prevent or delay the execution of the work for the elimination of mosquitoes or mosquito breeding. Upon the completion, to the satisfaction of said director, of any such work, said director shall certify to the comptroller, with proper vouchers, the amount of such costs, and the comptroller shall draw his order on the treasurer for the payment of the same.

Sec. 2. Section 2410 of the general statutes, as amended by chapter 21, of the public acts of 1919, is amended to read as follows: Whenever any swamp, marsh or other land has been drained to the approval of the director of the Connecticut Agricultural Experiment Station, he shall keep the same in repair and free from obstruction, and construct or repair tide gates or otherwise treat such areas so as to make such work effective. Said director may appoint one or more deputies to supervise the work done under the provisions of this and the preceding section, who may exercise the authority granted to such director. The expenses of said director and said deputies in carrying out the provisions of this and the preceding section shall be paid from funds provided by voluntary contributions or from funds appropriated by the state for such purpose. The comptroller may advance to said director such amounts within the appropriations therefor, as are necessary to meet the current expenses for labor authorized under the provisions of this and the preceding section. Any person obstructing the work of examining, surveying or ditching or otherwise treating such mosquito breeding areas, or obstructing any ditch, canal or drain, or the natural outlet of any marsh forming mosquito breeding areas, shall be fined not more than one hundred dollars or imprisoned not more than ninety days or both.

Approved April 17, 1923.

Under the old law, the cost of maintenance, not to exceed one dollar per acre in any one town, was paid by the State, and the town wherein the work was done reimbursed the State for three-fourths of the amount so expended for maintenance. This added about $2,500.00 to $3,000.00 to the regular appropriation.

The new law, which went into effect on July 1, 1923, provides that the State pay all expense of maintaining drained areas which have been approved by the Director. The sum of $12,000.00 was appropriated for mosquito elimination work during the two-year period from July 1, 1923 to June 30, 1925.

The total expenditure for the year was $8,944.87. Owing to the change in law this year, a detailed account of the above would be

too bulky to be included in this report. The Director's Report for 1923 covers the first half of the year, and his 1924 Report will include the remainder.

General Conditions.

Mr. S. T. Sealy, who has served as Deputy in Charge of the work for three years, resigned to take effect March 31, 1923, and Mr. B. H. Walden was placed in charge of this work temporarily. On July 1, 1923, Director Slate appointed the writer Deputy in Charge.

The general spring inspection showed much of the drainage work in poor condition. Many of the culverts at beach outlets were badly damaged and in some cases completely destroyed. The tide gates and dikes were found to be in fair condition, with the exception of the Stony Creek dike, which was badly damaged.

Although it is unlawful for any person to interfere with the free flow of water in any drainage system under State maintenance, the usual number of obstructions in ditches were found, caused by the careless dumping of rubbish, and by farmers and trappers. In many cases the outlets of ditches became clogged by a thick growth of sedge grass. The result is that some sections of the ditch tend to fill with mud, upon which grass takes root, the water is held back upon the marsh and breeding pools form. Thus in one season a neglected ditch may become a source of mosquito breeding.

For recutting ditches, a simple trimming tool was made consisting of two hay knives bolted to a light brace which held the blades in a parallel position the width of a ditch. A longer handle was attached for ease in operating. With this tool (shown on Plate XXI, a) both sides of a grass grown ditch could be trimmed at the same time. Several thousand feet of ditches were reclaimed this fall.

The absence of rain was a factor in preventing marsh pool breeding, although in some localities the continuous high tides offset this advantage. In every case where breeding was discovered, measures were taken to destroy the larvae and make their recurrence impossible.

The success of the anti-mosquito work this season is largely due to individuals, associations and towns contributing money and reporting mosquito infestations, also the co-operation of city departments, town officials, the board of health and others.

The Work By Towns.

NEW HAVEN.

The salt marsh mosquito breeding in this section was confined to an area in the Quinnipiac marsh north of Little River, the tide water being held back in about 80 acres of marsh by stones under Little River bridge at Middletown Avenue. The Bridge Department removed some of the stones and the water was lowered about ten inches. More stones will be removed next year.

No breeding was observed on the West River meadows. The harbor marsh and the ditched sections at Morris Creek were also kept free. Scattered breeding occurred at Fort Hale by reason of grass grown ditches and the high tide gate sill at the moat outlet. Upon request, the Park Department lowered the tide gate sill about seven inches. All of the ditches south of the Fort Hale road were recut this fall.

There was practically no mosquito breeding in other park property this season, although some *Anopheles* (malaria mosquitoes) larvae were discovered in Edgewood Park. The drainage system being installed at Beaver Swamp by the Park Department has eliminated the prolific *Anopheles* breeding there. One pool in that locality breeding *Culex* (house mosquito) was oiled. Many possible breeding places in the city parks have been filled.

WEST HAVEN.

Before work could be started this season a large brood of mosquitoes developed in the Old Field Creek marsh and infested the town. The tide gate at Beach Street was found badly damaged and blocked with a quantity of large stones. A large sand bar beyond the gate had completely closed the outlet to the harbor. The marsh above was flooded and much sewage was present. These conditions were ideal for mosquito breeding. Much labor was expended in this area keeping the outlet open, the tide gate in working order, and cleaning and recutting grass grown and mud filled ditches. In spite of our efforts, which were hampered by lack of funds, some scattered breeding was present throughout the season. The drainage system in the marsh is difficult to maintain on account of the frequent closing of the outlet by shifting sand. This results in the ditches filling with mud which in turn quickly grasses over. The outlet from the gate to the harbor should be deepened about two feet and a sluiceway installed to extend beyond the sand bar. A new tide gate is required and the creek should be dredged from Beach Street to Peck Avenue.

The other marshes in this section were kept free from breeding.

EAST HAVEN.

The two ditched areas of salt marsh in this section under State maintenance, one at Morris Creek and one at Silver Sands east of Caroline Creek, were kept free of mosquito breeding during the whole season. There was considerable breeding in the marsh near West Silver Sands not under State maintenance. These mosquitoes were troublesome periodically throughout the treated as well as the untreated areas.

The Town of East Haven has installed 978 feet of 18-inch corrugated iron pipe in Cosey Beach Avenue, extending from the property of Philip Smith to an extension of Caroline Creek.

The Connecticut Company has completed the filling of its marsh area at Momauguin including the ditch between this property and Philip Smith's which formerly carried the drainage water from a large swamp north of the road leading to South End. Adequate means of handling this water are to be provided by the property owners and connected to the 18 inch pipe laid by the town.

The State Rifle Range was inspected on June 12. Owing to the lack of rain nearly all of the depressions that hold water in an ordinary season were dry, and no mosquito larvae were found. There were many fresh water mosquitoes present which had emerged earlier in the season. These were especially abundant in the wooded or brush areas. In the open spaces many salt marsh mosquitoes were observed which had undoubtedly come from the undrained salt marshes in the southern part of the town.

BRANFORD.

Labor for maintenance of this section was furnished by Mr. L. E. Rice. In some cases mosquitoes got on the wing before the areas could be treated. At Sunset Beach the natural outlet was found to be closed by large rocks which were removed at considerable cost. The Sybil Creek marsh north of the tide gates on the Indian Neck road was covered with water. This situation was partly corrected by lowering the bed of the creek under the road bridge. Many of the ditches in this area were filled with soft mud and grassed over, creating breeding pools on the marsh surface and in ditches. Several thousand feet of ditches were recut and deepened. No breeding was discovered on other marshes in this section.

The large marsh at Stony Creek has been flooded all the season due to a broken dike. Presumably there was some breeding on this marsh which accounts for some complaints of mosquitoes in Stony Creek Center. State funds were insufficient to repair this dike, but the meadow owners and some public spirited summer residents contributed generously and the dike was repaired. The ditches in this marsh are badly damaged, and it is doubtful if they can be reconditioned next spring in time to prevent early breeding. The tide gates at Hubbard's Bridge on the Branford River need repairs.

GUILFORD.

Maintenance work was started promptly in this section by Mr. Frank Blatchley and continued throughout the season. No breeding was discovered and no complaints received.

Several hundred feet of ditches were recut in the vicinity of Shell Beach and a bad leak under the tide gate sill at Great Harbor stopped. The labor was furnished by one of the summer residents. The area of this section is too great to be properly maintained by one man, and some of the ditches have become grass grown and

filled with mud. This condition will produce breeding pools in a wet season.

MADISON.

The only serious outbreak of mosquitoes in this section occurred early at the Hammonasset State Park. These were troublesome periodically throughout the first half of the summer. Oil and labor were furnished by the State Park Commission and millions of larvae in clogged ditches and marsh pools were destroyed. As soon as the offending ditches were cleaned and graded, no further breeding occurred. Plans are under way to carry on a vigorous anti-mosquito campaign at Hammonasset next year in co-operation with the State Park and Forest Commission.

No breeding was discovered in other marsh areas of this section, and no complaints were received. Much additional labor will be required to recondition some of the ditches, which during a normally wet season will no doubt become a source of mosquito breeding.

The most important part of mosquito control work in this section consists of keeping the several beach outlets open. This was accomplished during the entire season by Mr. Russell Bartlett and but little time remained to patrol the marsh sections properly. This section is too large for one man to maintain at this time owing to gradual deterioration of the drainage works.

The culverts at the beach outlets have been damaged or totally destroyed at some previous time by storms. When these are replaced the labor expended in opening these outlets every few days will go far in reconditioning and maintaining the ditches in the potential areas.

WESTBROOK.

This year the Town of Westbrook appropriated $1,000.00 to start mosquito elimination work in this section. This amount has been increased by generous contributions from a few public spirited citizens. The money was turned over to the Connecticut Agricultural Experiment Station, under whose supervision the ditching of the marshes will proceed.

The long search for suitable labor delayed the start of ditching until December 12. Work was begun on December 12 in Rushy Meadow at Middle Beach. In order to remove the surface water from this flooded and soggy area, about 1,770 feet of old ditches were first recut and deepened. The old ditches were not sufficient to remove all of the pools and 756 feet of new ten inch ditches were cut. Later these ditches will be deepened as required. The outlet of this marsh will require the installation of a 100 foot culvert to carry the water beyond the point of moving sand.

On the small marsh east of the property owned by Mr. Thomas Fisk, 441 feet of old ditches were recut and 510 feet of new ditches dug. The creek bed was widened and graded. A culvert will be required here as at Middle Beach. At the athletic field, 681 feet of old ditches were recut and 291 feet of new ditches dug. A total of 5,112 lineal feet of ditching was installed this year, much of which will require deepening to secure proper drainage.

Ditching was begun on the Broad Creek marsh and on the Lewis marsh south of the railroad track. All the new ditches in this section are being cut with hay knives, using a plank ten inches wide as a guide for cutting the sides of the ditch. The sods are pulled out with potato hooks and a satisfactory ditch is obtained after the bottom is graded.

The drainage work of Rushy Meadow and the Fisk marsh will be completed early next season if no further difficulties develop. These two marshes were found to be the most poorly drained salt marsh areas in Westbrook. They will no doubt prove to be the most costly to drain per acre and the most costly to maintain. As soon as the drainage of an area is completed and approved by the Director of the Connecticut Agricultural Experiment Station, the drainage works of that area will be maintained at State expense.

The other Westbrook marshes are dotted with stagnant pools and it is doubtful if much relief from mosquitoes will be afforded by the present expenditure.

OLD SAYBROOK.

A small ditched marsh area at Fenwick under private maintenance was inspected this fall, but owing to the high tide at that time the exact condition of the ditches could not be determined accurately.

GROTON.

The ditched area at Groton Long Point under State maintenance was thoroughly patrolled. On account of the foot bridge over the marsh outlet having been washed away, large stones had been rolled in for crossing. This interfered with the free movement of water and the stones were removed each trip. A road culvert was found closed due to careless dumping of rubbish and some breeding resulted in the flooded area. Some of the ditches will be recut next season.

FAIRFIELD.

The drained salt marsh areas in this section under State maintenance were kept in good condition throughout the season by Mr. Nicholas Matiuck, with an average crew of two men. Nine hundred gallons of light fuel oil were purchased from the Standard Oil Com-

pany by contract. Breeding places in salt marshes and especially in the fresh water areas which could not be otherwise treated were oiled throughout the season. The breeding of salt marsh mosquitoes has been reduced to a minimum.

The fresh water problem of this section is under the immediate supervision of Dr. V. Havard, Secretary of the Fairfield Improvement Association, with Nicholas Matiuck in charge of the field work.

In 1922, a survey of the fresh water breeding places was made in this section including an estimate of the amount of labor and material required for treatment. Much public interest was aroused and generous contributions were received. During 1922, $1,081.94 was spent by the Association to treat these fresh water areas. All of this fresh water work was instigated and carried out by the Fairfield Improvement Association, to which great credit is due. The oil and the services of Nicholas Matiuck were contributed by the State.

In 1923, the Town of Fairfield appropriated $2,000.00 to carry on the work. The anti-mosquito activities in Fairfield have proven very successful and other towns are recommended to follow its example.

STAMFORD.

The salt marshes in this section were carefully patrolled by Nicholas Matiuck with an average crew of two men. The ditches were kept open and marshes were properly drained the whole season.

The City of Stamford continued its treatment of the fresh water areas.

MISCELLANEOUS INSECT NOTES.

Swarms of Butterflies.—On August 25, specimens of the milkweed or monarch butterfly, *Anosia plexippus* Linn., were received from Mrs. Edw. B. Rogers, Southport, who wrote that these butterflies were extremely abundant and lighted upon maple and other trees. These butterflies often migrate in large numbers and there are several accounts in entomological journals where swarms have passed the night on trees and shrubs.

Giant Water Bug.—On July 19, Mr. Pierrepont B. Foster of Hamden brought to the Station a large aquatic bug which had attacked and killed a gold fish in his pool. This bug was *Lethocerus americanus* Leidy, known as the giant water bug or electric light bug. It is aquatic during its immature stages but when it has reached the adult stage, it often leaves the water and flies about arc lights at night. It is predaceous in all stages.

European House Cricket.—On April 14, specimens were brought to the writer from an apartment house on George Street, New Haven, of the European house cricket, *Gryllus domesticus* Linn. (See Plate XXIII, b). This insect was said to be extremely abundant in the basement of the building. The individuals could be found in the cracks and crevices of the masonry walls and the tenants were greatly disturbed on account of the infestation. After conferring with the writer, the owner made applications of some prepared roach powder with a blower, and reported that the treatment seemed to be successful.

The Birch Leaf Skeletonizer.—This insect has continued to be prevalent and has skeletonized the leaves of gray birch trees throughout the State. Other species of birches were attacked but were not so conspicuously brown as were the gray birches. The injury was about the same in 1923 as in 1922, and is caused by a small moth called the birch leaf skeletonizer, *Bucculatrix canadensisella* Chambers. The life history of this insect has not been completely worked out. It is the larvae feeding upon the leaves which cause the injury, and if choice shade trees are sprayed with lead arsenate late in July or early in August, this injury will be prevented.

Spruce Leaf-Miner.—On May 7, spruce twigs were received from the F. A. Bartlett Tree Expert Company of Stamford, the leaves of which had been mined by the spruce leaf-miner, *Recurvaria piceaella* Kearf. Descriptions and life history notes regarding this species may be found in a paper by W. D. Kearfott in the Journal of the New York Entomological Society, Vol. XI, page 151, 1903. It is said to attack red spruce in the New England States and black spruce in northern New Jersey. The larva is red on dorsal lateral and ventral surfaces, with a dark green patch on the dorsum of each abdominal segment. Head and thoracic shield, pale brown. No remedy is known.

European Pine Shoot Moth in Connecticut.—On November 24, Mr. Filley brought to the laboratory from Ridgefield, some twigs of red or Norway pine, *Pinus resinosa,* which had been deformed and the buds eaten in the manner caused by the European pine shoot moth, *Evetria buoliana* Schiff. No insects were found in this material, but on October 13, twigs of the same species of pine injured in the same manner were received from Tarrytown, N. Y., containing two brown larvae which we were able to identify as *E. buoliana.* The larvae destroy the buds and this induces the lateral shoots to grow, and many of them become curved, twisted and distorted. Though it seems to prefer the red pine here, it also attacks other pines especially the Scotch, white, Austrian and Mugho pines.

The Box Leaf-Miner.—On November 23, specimens of box twigs were received from the Harkness Estate, Waterford, infested with the box leaf-miner, *Monarthropalpus buxi* Labou. The infested leaves were somewhat curled and showed on the upper surface some indications of irregular mines within. On dissecting, the upper epidermis separated easily from the lower and there were many small whitish green maggots between the layers as is shown on Plate XXIII, a. Dr. Garman visited the place a few days later with a view to studying the insect and testing control measures, but the conditions were not quite suitable for this purpose. The remedies recommended are to spray the foliage thoroughly about May 1 with a miscible oil, one part in 20 parts water, to which is added one pint of 40 per cent. nicotine sulphate per each 50 gallons of mixture. This treatment should be repeated about a week later. In Maryland, success was obtained by spraying the foliage at the time the adults emerge, with molasses diluted one part to three parts of water, this mixture entangling the flies as they emerged or before laying eggs.

Apple and Thorn Skeletonizer.—Full information regarding this insect may be found in Bulletin 246 of this Station, issued in June, 1923. During the season of 1923 there has been abundant opportunity for observing the work of this insect, which has now spread over the entire State. Professor A. E. Stene, State Entomologist of Rhode Island, informed the writer that the pest occurs in Rhode Island. The writer observed injury to apple trees beside the highway in going between Westerly and Providence, R. I., on August 16, which he attributed to this insect. At a conference in Boston, Mass., August 17, apple twigs injured by it and collected on the Massachusetts north shore were shown to the writer. Therefore it has spread throughout southern New England in three or four seasons.

The latter part of July during the summer meeting of the Entomologists of the Northeastern United States, which was held in Connecticut, the apple trees between New Haven and Hartford were brown from the feeding of the larvae of the second brood. Certain trees near New Haven, however, were not so seriously injured as in 1922.

Swarms of the Chain-Dotted Geometer.—On the evening of September 27 and for a few nights thereafter, swarms of thin whitish moths gathered around the "white way" lights in the center of New Haven. The attention of the writer was called to the matter by one of the newspapers, and on investigation the insect was found to be the chain-dotted geometer, *Cingilia catenaria* Drury. Smaller numbers of these moths were found during the daytime clinging to lamp posts, the walls of buildings or on the sidewalks. The caterpillars of this moth feed upon the leaves of

bayberry and sweet fern, when abundant, often defoliating these shrubs. They are slender yellowish larvae, with two conspicuous black spots just above each spiracle, and dorsally striped lengthwise with faint narrow lines. When fully grown they are from one and one-half to one and three-fourths inches in length. The pupa is enclosed in a loose net fastened to the leaves. The moth has a wing-spread of about one and one-half inches, is white, with chains of black dots across the wings. Larva, pupa and adult are shown on Plate XXIV.

Flight of Cotton Moths.—On September 12 and 13 there were swarms of cotton moths, *Alabama argillacea* Hubn., in New Haven, Bridgeport, Stamford and doubtless other cities and towns of the State. They fluttered around the stronger lights during the night time and in day time were resting often head downward on the plate glass store windows, walls of buildings and lamp posts. Similar flights have been noted in former years, and in the Report of this Station for 1911, page 339, and for 1912, page 217, are notes regarding the appearance of this moth in Connecticut in those seasons. The moth is a uniform light reddish brown with white discal spots on the fore wings. When resting the wings are folded in the shape of a double roof (Λ) and the moths present a trim and attractive appearance. The caterpillars are known as "cotton worms" in the southern States and are not known to feed on other plants. In some seasons they are extremely numerous in the cotton States, and the adults migrate northward often in enormous numbers and are sometimes reported from many of the northern States and Canada, usually in September and October. This insect is not known to hibernate in the United States, unless possibly in Texas. The adult is shown on Plate XXIV, d.

A Japanese Weevil in Connecticut.—On July 29, 1920, Messrs. Zappe and Walden while inspecting nursery stock in a nursery in New Haven, collected some curious fat brown weevils which were new to the Station collection, and which were unfamiliar to Mr. Zappe. Mr. Zappe collected more of the same species on July 26, 27 and 30, 1921, and on June 24 and July 21 and 27, 1922. Mr. Walden also collected one specimen on July 21, 1922. In 1923, some collecting was done in the vicinity but no specimens of this weevil were obtained. Specimens were sent to Mr. H. C. Fall, who replied that it was probably introduced from some other country. On May 15, 1922, the writer took some specimens to Mr. E. A. Schwarz at the U. S. National Museum, Washington, D. C. Mr. Schwarz stated that the species was not represented in the National Museum and that it might be difficult and take considerable time to identify it. On May 28, 1923, Mr. Zappe took some specimens to the American Museum of Natural History in New York City and left them with Mr. A. J. Mutchler, who said

he would show them to Mr. C. W. Leng and possibly between them they might be able to fix its identity. Not succeeding, Mr. Mutchler afterward sent it to Dr. G. A. K. Marshall of the British Museum, London, who replied in part as follows:

"The insect is, as your information suggested, a Japanese species, *Pseudocneorrhinus setosus* Roelofs. I am not aware, however, that anything has been recorded with regard to its habits or life history. I trust that it has not yet established itself in the United States."

According to the observations of Mr. Zappe, the adults feed upon the leaves of burr marigold, *Bidens* sp. So far we have been unable to obtain any information about the immature stages of this insect. The adult is shown on Plate XXIV, e.

Authorship.

For bibliographical purposes all notes and articles in this Report (Bulletin 256) should be credited to W. E. Britton, except where otherwise indicated.

Illustrations.

The illustrations in this Report (Bulletin 256) are from the following sources: text figures are all from drawings as follows: Fig. 9, map drawn by A. E. Moss, shaded by Stoddard Engraving Company; Fig. 10, drawn by B. H. Walden; Fig. 11 drawn by Philip Garman; Fig. 12 after Howard, Bulletin 25, Bureau of Entomology, U. S. Department of Agriculture; Figs. 13, 14 and 16 after Smith, New Jersey Agricultural Experiment Station; Fig. 15 drawn by L. H. Joutel. The plates are all from photographs from the following sources: XXI, c, and XXII, b, by R. C. Botsford; XI, a, and XIII, by W. E. Britton; XIX, a, XX, c, and XXII, a, by Philip Garman; X, b, by G. H. Hollister; XIV, XV and XVI by J. Leslie Rogers; XVIII, a, by Bureau of Entomology, U. S. Department of Agriculture; all others by B. H. Walden.

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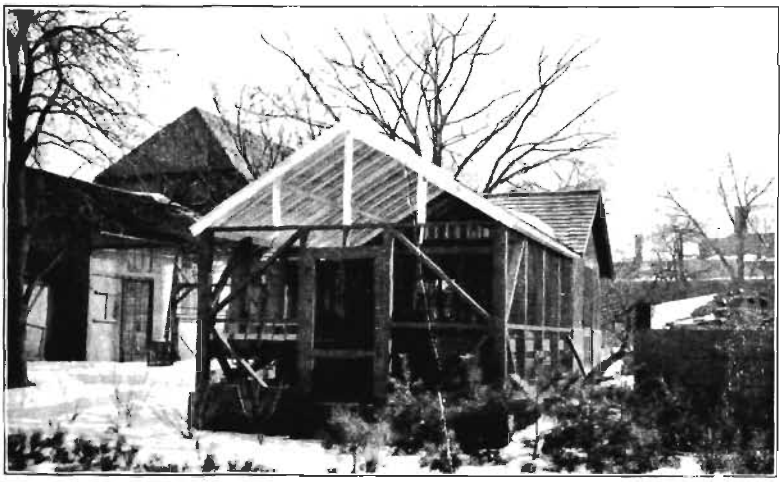
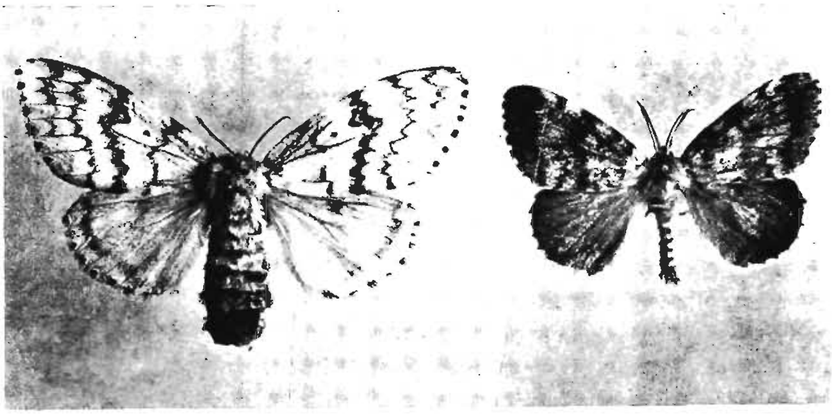
a. Field insectary at Station Farm, Mount Carmel, at the time of the Entomologists' field meeting.



b. Enlarged insectary at Station.

NEW EQUIPMENT.

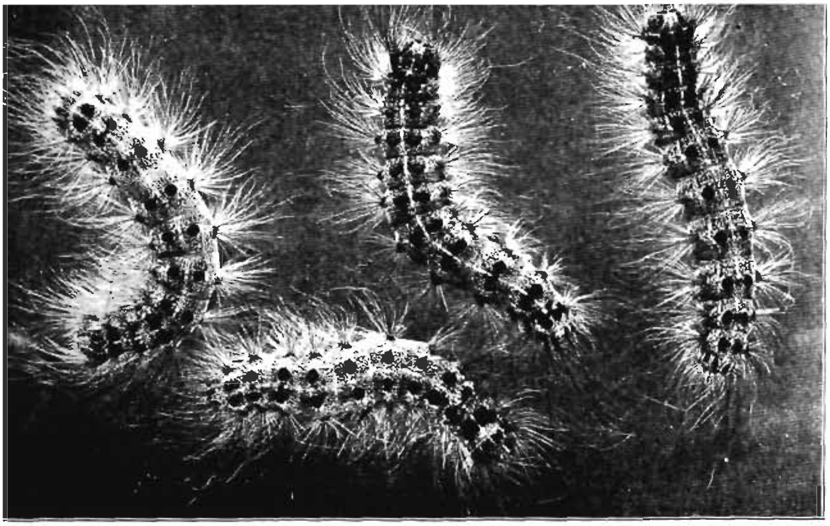
PLATE X.



a. Female and male gipsy moths. Natural size.

b. Treating an egg-mass with creosote.

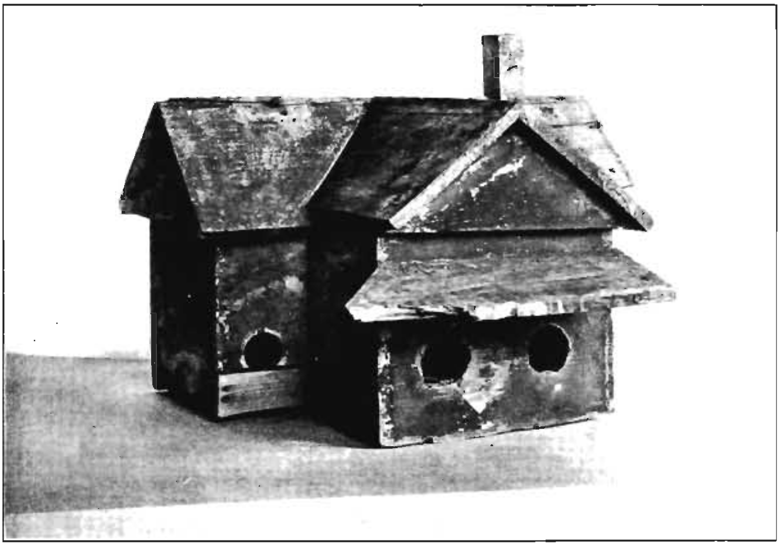
GIPSY MOTH CONTROL WORK.



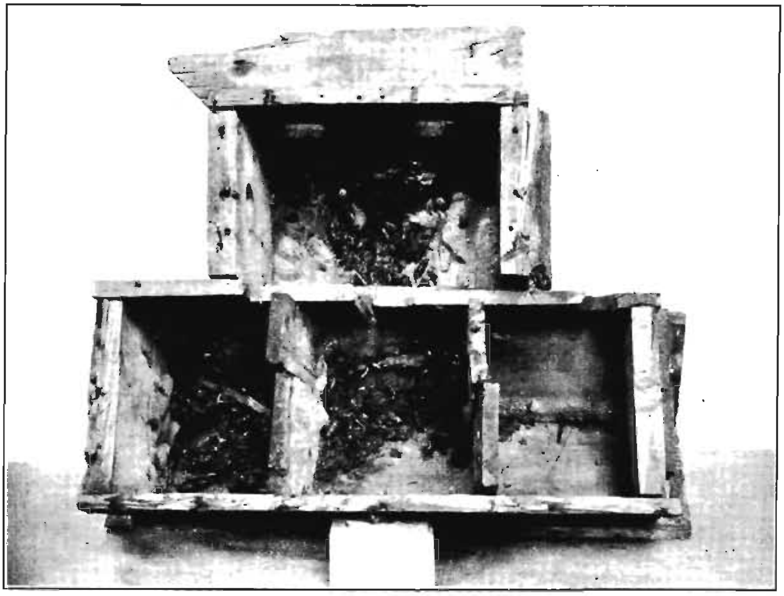
a. Gipsy moth caterpillars. Natural size.

b. Egg-clusters and pupae on inside of loose hickory bark.

GIPSY MOTH CONTROL WORK.



a. An innocent looking bird house.



b. Inside of the bird house containing about 107 cocoons and 35 egg-masses.

GIPSY MOTH CONTROL WORK.

a. View in garden where first infestation was found in Connecticut. Groton, November 10.

b. Another view in same garden.

EUROPEAN CORN BORER.

PLATE XIV.

a. Burning weeds and rubbish with Federal burning truck, infestation No. 1, Groton.

b. Burning weeds and rubbish at infestation No. 2, Groton.

EUROPEAN CORN BORER.

a. Weeds at infestation No. 2, Groton, before burning.

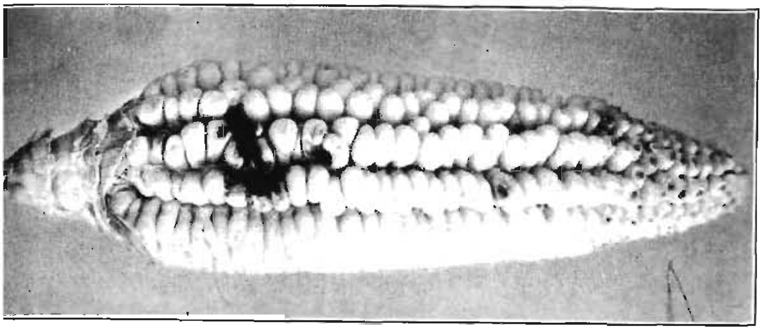
b. View of same field after burning.

EUROPEAN CORN BORER.

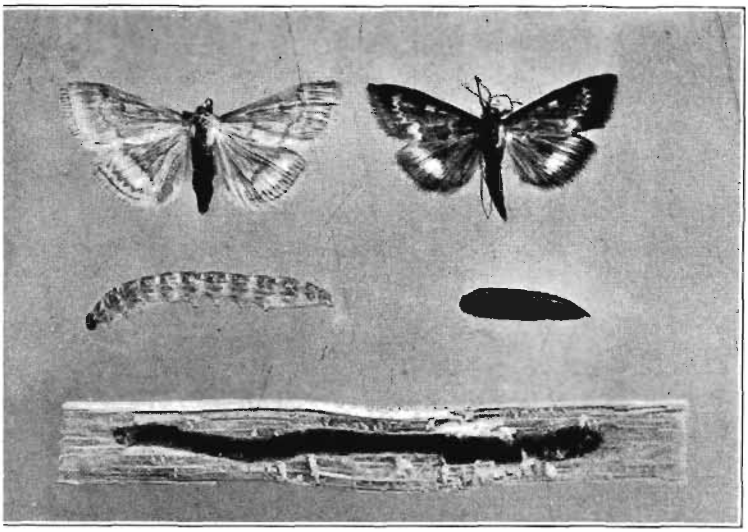
a. Burning corn stalks with the aid of oil applied with hand sprayer, infestation No. 1, Groton.

b. Burning weeds with power outfit, infestation No. 2, Groton.

EUROPEAN CORN BORER.

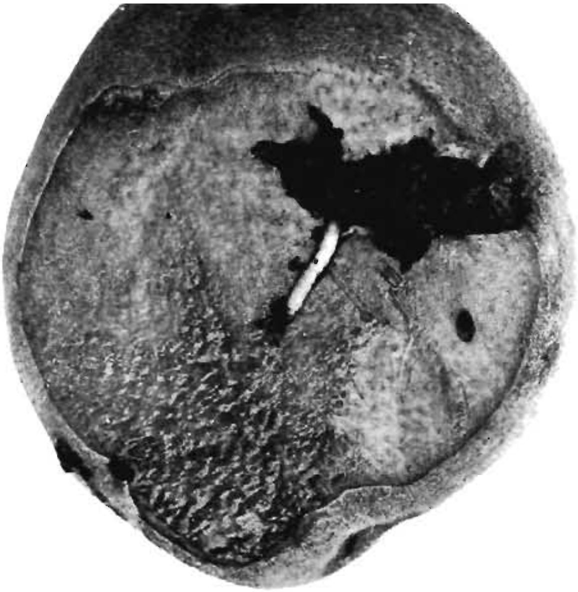


a. Slight injury to ear of sweet corn, Groton.

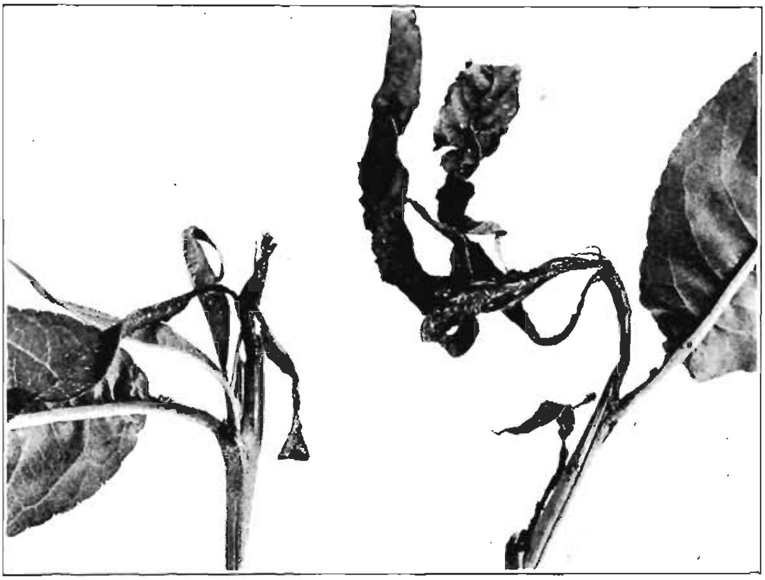


. Female, male, larva, pupa and burrow in cornstalk. Slightly enlarged.

EUROPEAN CORN BORER.

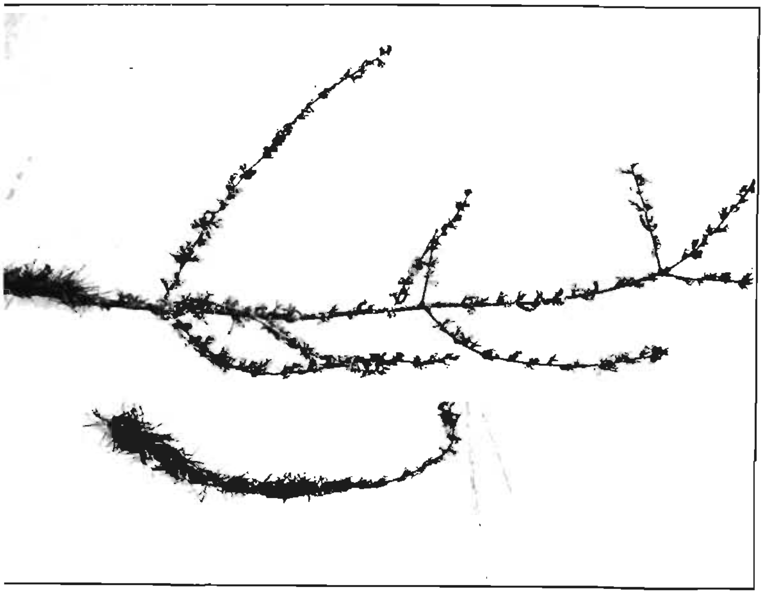


a. Infested peach cut open to show larva. Somewhat enlarged. (After Quaintance and Wood, Bureau of Entomology, U. S. Department of Agriculture.)

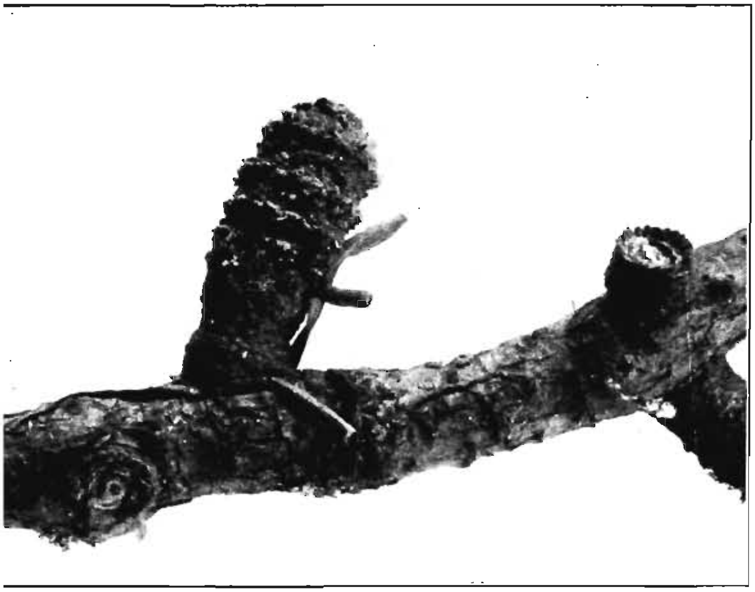


b. Peach twigs which have been injured by the larvae. Natural size.

ORIENTAL PEACH MOTH.



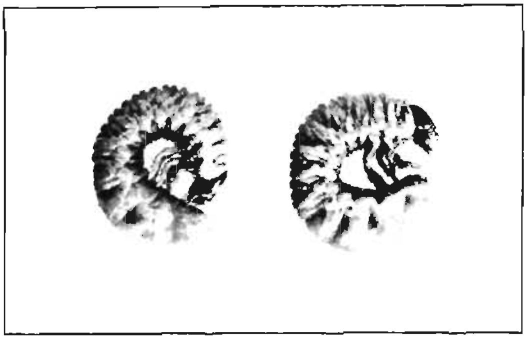
a. Appearance of injured leaves in June.



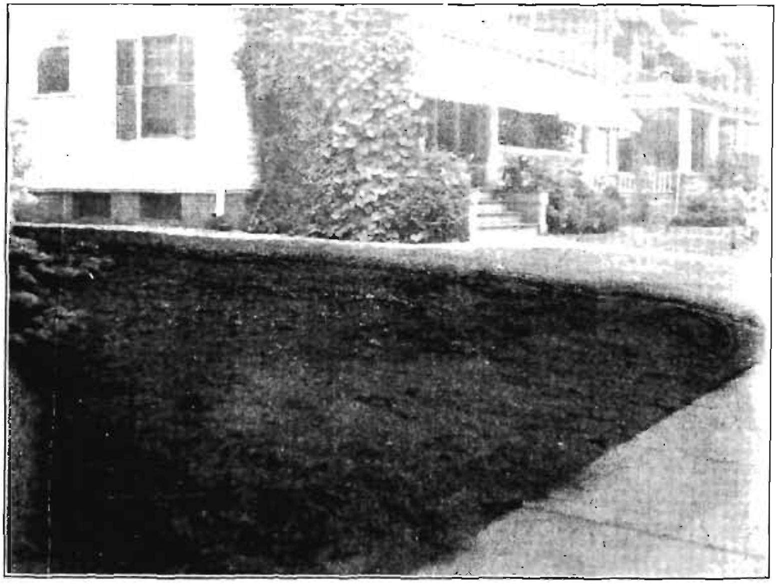
b. Winter cases fastened to twigs, four times enlarged.

LARCH CASE BEARER.

a. Adults showing variation from light brown to black, twice natural size.

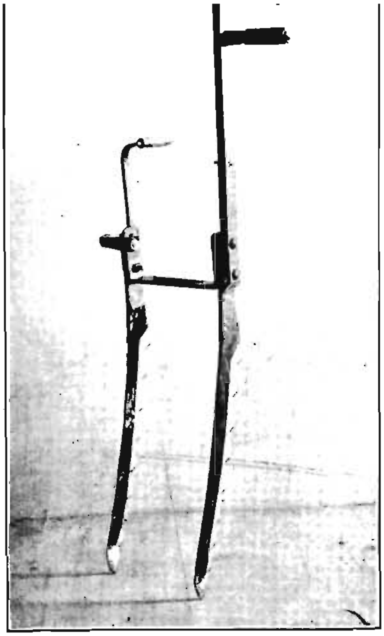


b. Larvae or grubs, twice natural size.

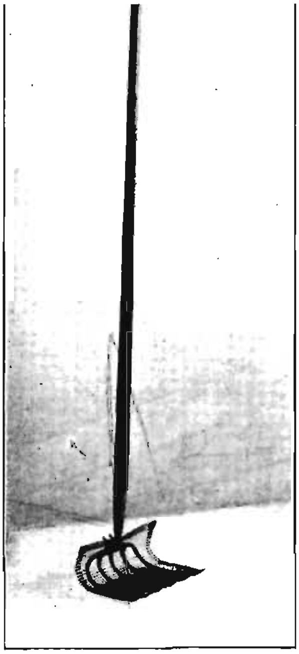


c. Lawn injured by grubs. Grass has been killed in the foreground but back towards the house it is uninjured.

ASIATIC BEETLE.



a. Modified hay knife for recutting ditches in salt marsh.



b. Potato hook with prongs covered with wire netting, for removing mud from ditches.

c. Installing a metal culvert through a sand beach to drain the marsh beyond, Westbrook.

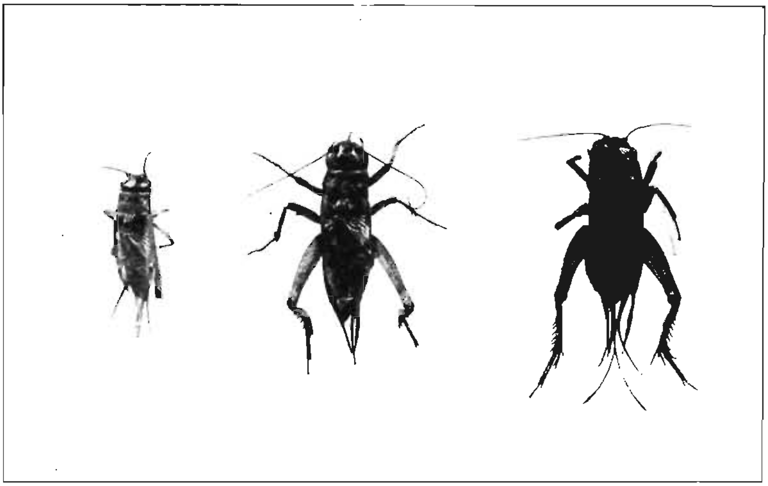
MOSQUITO ELIMINATION WORK.

a. Broken dike, Stony Creek.

b. New dike, Stony Creek.

MOSQUITO ELIMINATION WORK.

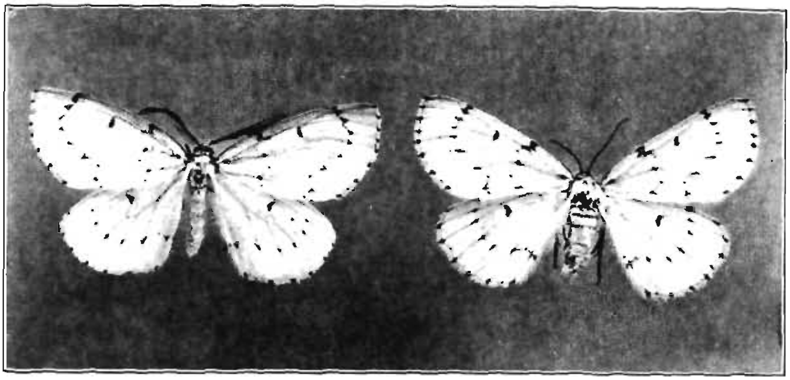
a. Box leaf-miner. White spots on leaves indicate infestation. Lower epidermis has been removed from two leaves, showing maggots. Natural size.



b. European house cricket. Somewhat enlarged.

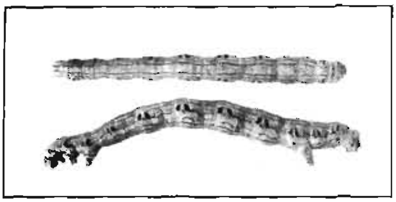
BOX LEAF-MINER AND EUROPEAN HOUSE CRICKET.

PLATE XXIV.

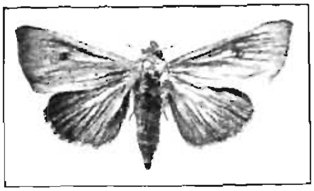


a. Chain-dotted geometer. Adult male and female, natural size.

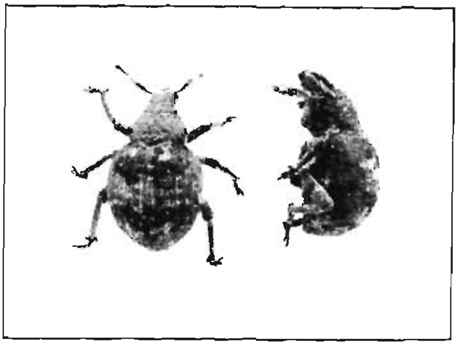
b. Cocoon, natural size.



c. Larvae, natural size.



d. Cotton moth, natural size.



e. Japanese weevil, four times enlarged.

CHAIN-DOTTED GEOMETER, COTTON MOTH AND JAPANESE WEEVIL.

BULLETIN 257 APRIL, 1924

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

REPORT ON INSPECTION OF COMMERCIAL FEEDING STUFFS

1923

E. M. BAILEY

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

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April, 1924.

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ESSENTIAL PROVISIONS OF THE STATUTES RELATING TO FEEDING STUFFS.

1. All concentrated feeding stuffs must be labelled.

2. The label may be a printed statement on the bag or a tag attached thereto.

3. The label must declare the number of net pounds in the package, the name, brand or trade mark under which the article is sold, the name and address of the manufacturer or jobber, and must give the analysis.

4. Dealers receiving feeds in bulk are responsible for proper labelling of such feeds when bagged by them to be sold or offered for sale. They should require the consignor of such bulk feeds to furnish analyses and other information necessary for proper labelling.

5. Dealers mixing their own brands of stock feeds, dairy feeds, poultry mashes, etc., are responsible for the proper labelling of their products.

6. Cottonseed meal, whether used for a feeding stuff or a fertilizer, must be registered with this Station as a fertilizer and a registration fee paid for each brand registered. A distinctive brand name or a different analysis constitutes a distinct brand.

7. Feeding stuffs other than cottonseed meal have not heretofore been required to be registered. Section 4777 provides, however, that such registration shall be made upon request of this Station. The Station and the Dairy Commissioner believe that such registration is desirable and it is now being asked for. No fee for such registration or for analysis is required.

8. The use of wire or any metal in affixing tags is prohibited by law.

Commercial Feeding Stuffs.

E. M. Bailey.*

TEXT OF THE LAW.

Although no substantial changes have been made in the feeding stuffs law in this State in recent years, nevertheless official inspections have shown that some of the provisions of the law are not understood or are being ignored. For the benefit of wholesale and retail dealers in feeding stuffs the text of the law is here given with comment upon those points which require emphasis.

Section 4774 of the General Statutes defines "Concentrated Commercial Feeding Stuff" as follows:

"The term 'concentrated commercial feeding stuff' shall include linseed meals, cottonseed meals, pea meals, cocoanut meals, gluten meals, gluten feeds, maize feeds, starch feeds, sugar feeds, dried brewers' grains, malt sprouts, hominy feeds, cerealine feeds, rice meals, oat feeds, corn and oat chop, corn and oat feeds, ground beef, fish scraps, mixed feeds, provenders, bran, middlings and mixed feeds made wholly or in part from wheat, rye or buckwheat and all materials of a similar nature, but shall not include hays and straws, the whole seeds nor the unmixed meals made directly from the seed of wheat, rye, barley, oats, Indian corn, buckwheat or broom corn nor feed ground from whole grain and sold directly from manufacturer to consumer."

From this it appears that practically all feeds excepting hay and straw, whole seed, unmixed meal made directly from any of the cereals or from buckwheat, and feed ground from whole grain and sold directly from manufacturer to consumer, are included in the term "Concentrated Commercial Feeding Stuff".

Section 4775 states the requirements as to labelling. This section reads as follows:

"Every lot or parcel of concentrated commercial feeding stuff, sold, offered or exposed for sale, shall have affixed thereto in a conspicuous place on the outside thereof a plainly printed statement, except as provided in section 4776, certifying the number of net pounds of feeding stuff contained therein, the name, brand or trade-mark under which the article is sold, the name and address of the manufacturer or importer, and a statement of the percentage it contains of crude fat and of crude protein, both constituents to be determined by the methods adopted at the time by the association of official agricultural chemists of the United States, but such lot or parcel shall not be sold, offered or exposed for sale with such statement affixed thereto by any wire or other metal".

*Analyses are chiefly by Messrs. Nolan and Fisher; inspection and sampling by Mr. Churchill; compilation of results largely by Miss Bacon.

In accordance with this section all concentrated feeding stuffs must bear *upon the bag*, or *a tag attached thereto*, a statement giving the *name and address* of the manufacturer or importer, the *number of net pounds in the package*, the *name of the article* and the *percentage of protein and fat* contained in it. Dealers receiving feeding stuffs in bulk to be bagged and distributed by them should see to it that tags bearing a correct analysis and other information required by law are attached to the bags before the feeds are sold or offered for sale. Dealers mixing their own brands of feeds are responsible for the proper labelling of their products. *It is illegal to use wire* or any other metal in affixing tags.

While the law requires that only the percentage of *protein* and of *fat* be stated, there is no objection to a statement of the complete chemical analysis. Likewise, in the case of mixed feeds, there is no objection to a statement of the ingredients used in compounding them, but the law in this State does not require it. If, however, such additional information is given it is expected to be correct.

If a complete analysis is given the term *"nitrogen-free extract"* as used therein means the figure obtained by deducting the sum of the percentages of moisture, ash, protein, crude fiber and fat from 100 per cent. The term *"carbohydrates"* includes the nitrogen-free extract and crude fiber.

Section 4776 relates to cottonseed meal when sold for fertilizer. It reads as follows:

"Whenever cottonseed meal is sold for fertilizer, the dealer shall, with the consent of the purchaser, issue in lieu of the printed statement provided for in section 4775, a certificate which shall contain the statements required by section 4775".

Attention is called to the fact that, under the fertilizer law, cottonseed meal is classed as a fertilizer. *All cottonseed meal and each brand thereof, sold, offered or exposed for sale in Connecticut must, therefore, be registered as a fertilizer with this Station and an analysis fee of ten dollars paid thereon. Distinctive names or different guaranties of composition constitute distinct brands.*

Section 4777 relates to registration of feeds as follows.

"Every manufacturer, importer, agent or seller of any concentrated commercial feeding stuff shall, upon request, file with the Connecticut Agricultural Experiment Station a certified copy of the statement prescribed in Sections 4775 and 4776."

The law does not require the registration of feeding stuffs, *except* upon request of this Station. *As already noted, however, it is considered advisable to have feeding stuffs registered and such registrations are now being asked for.*

Section 4778 provides the penalty for violations of the law. It reads as follows:

"Every manufacturer, importer, agent or person selling, offering or exposing for sale any concentrated commercial feeding stuff in relation to which all the provisions of sections 4775, 4776 and 4777 have not been complied with, shall be fined not more than one hundred dollars for the first offense and not more than two hundred dollars for each subsequent offense."

Section 4779 relates to the inspection and analysis of feeds and the publication of the results for public information. This section provides that:

"The Connecticut Agricultural Experiment Station may collect a sample, not exceeding two pounds in weight, for analysis, from any lot, parcel or package of concentrated commercial feeding stuff, or unmixed meals, brans or middlings, which may be in the possession of any manufacturer, importer, agent or dealer, but said sample shall be taken in the presence of the parties in interest or their representatives, and taken from a number of parcels or packages which shall not be less than five per centum of the whole lot inspected, and shall be thoroughly mixed, divided into two samples, placed in glass vessels, carefully sealed, and a label placed on each stating the name or brand of the feeding stuff or material sampled, the name of the party from whose stock the sample was taken, and the time and place of taking the same; said label shall be signed by the station chemist or his deputy, and by the party or parties in interest or their representatives present at the taking and sealing of said sample; one of said samples shall be retained by said chemist or his deputy and the other by the party whose stock is sampled. Said station shall cause at least one sample of each brand of feeding stuff so collected to be analyzed annually by or under the direction of said chemist. Said analysis shall include determinations of crude fat and crude protein and such other determinations as may be advisable. Said station shall cause the analysis so made to be published in station bulletins, together with such additional information in relation to the character, composition and use thereof as may be of importance and issue the same annually or more frequently if advisable".

Section 4780 provides for the enforcement of the law. It says:

"The dairy and food commissioner shall enforce the provisions of this chapter, and when evidence is submitted by the Connecticut Agricultural Experiment Station that said provisions have been violated, he shall make complaint to the proper prosecuting officer".

The dairy and food commissioner is charged with the enforcement of the law and prosecutes violations upon evidence submitted by this Station.

Section 4781 defines the term "importer" as used in the law as follows:

"The term 'importer' shall include such persons as shall bring into or offer for sale within this state concentrated commercial feeding stuffs manufactured without this state".

GRATUITOUS ANALYSES OF FEEDING STUFFS.

Samples Submitted By Individuals.

The foregoing relates to the inspection of feeding stuffs for purposes of official control. The Station is frequently called upon, however, to make analyses of feeds upon samples drawn by the

individuals interested. While the Station assumes no responsibility for the sampling in such cases, it insists that the samples be taken substantially as prescribed by law. Blank forms to be filled out by the person submitting the sample will be supplied by the Station upon request.

Dealers who mix their own formulas sometimes submit samples for the purpose of using our analysis as a basis for their guaranty. The Station assumes no control in such matters, and in no way guarantees that such analysis represents the minimum or average composition of the stock sampled; it is responsible only for the correctness of the analysis of the sample submitted.

While the Station is disposed to cooperate with both farmer and dealer in the matter of gratuitous analyses it reserves the right to refuse this privilege in case samples are submitted from any source with such frequency as to warrant the belief that its resources are being used to exercise systematic control over purchases made by an individual buyer. This policy applies not only in the case of feeding stuffs but to fertilizers and gratuitous work in general.

Description of Sample.

For a proper description of a sample of feeding stuff the following information should be given:

Sampler's identification mark or number.
Name of the feed.
Name and address of the manufacturer or jobber.
Name and address of the dealer.
Car Number.
Number of sacks from which sample was taken.
Guaranty:
- Protein,
- Fat,
- Other constituents if given.

Date of sampling.
Price per ton.
Remarks.

Instructions for Sampling Feeding Stuffs.

An analysis is of no value if the sample submitted is inadequate or carelessly taken. In cases of special importance the Station may be requested to send its agent to draw samples.

Provide a sampling tube, some large papers, and for each sample a glass jar or tin box that can be tightly closed. Containers, sampling tube, etc., should be clean and dry.

The quantity of the sample should be not less than one pint.

Open at least three full unbroken packages (or bags), or if there are more than thirty, one in every ten packages, or from a car lot not less than twenty packages, remove a *core* from each opened package by inserting the sampling tube the full length of the package, mix the portions thus drawn thoroughly

and as quickly as possible, fill the can or box from the mixture, close tightly and identify the sample with some distinguishing number or letter.

If the feed is in bulk draw portions from various parts of the pile, the number depending upon the size of the pile; twenty portions should be drawn for a sample from a carload.

If a sampling tube is not available a fairly satisfactory sample may be obtained as follows: Mix the contents of each package for a foot in depth, take a cupful from each package, mix the portions thus drawn and prepare the sample as already described.

Samples drawn by means of a sampling tube are much more reliable.

Send the sample prepaid to the Connecticut Agricultural Experiment Station, New Haven, Conn., and enclose with it or mail separately the *description of the sample* as herein described.

RÔLE OF THE NUTRIENTS.

Water. Air dry feeding stuffs, whether concentrates or roughage, still contain some moisture which cannot be seen or felt. The amount of such moisture averages not far from ten per cent. While not a nutrient in the ordinary sense, water is essential to the animal; but since it is obtained in abundance from sources other than the feed, its presence therein is not of importance. Excessive amounts, however, jeopardize the keeping qualities of a feed and automatically reduce the percentage of the more desirable ingredients.

Ash. The importance of mineral constituents in feeds is emphasized by the fact that animals fed upon rations deprived largely or entirely of ash constituents generally die sooner than animals which have been given no food at all. Giving stock mineral matter in addition to that obtained in the daily ration is an old and familiar practice among experienced stockmen who have long "salted their cattle" with common salt (sodium chloride), the commercial grades of which contain small and varying amounts of other minerals such as calcium, magnesium, iron and phosphorus and sulphur. Recent studies in nutrition have shown some of the specific needs which minerals satisfy in the vital processes. Thus big neck in calves, colts and lambs, and hairlessness in pigs are now attributed to iodine deficiency in the feed; and defective skeletal formation in growing animals is due either to a lack of calcium and phosphorous or to an absence of the necessary agency to make the proper utilization of these minerals possible, for it has been shown that without what has been called the fourth, or antirachitic, vitamine which is present in cod liver oil and in green plant tissues, calcium and phosphorous cannot be properly assimilated.

Protein. This nutrient group is estimated by determining the amount of nitrogen which a feed contains and multiplying that amount by the factor 6.25 on the assumption that proteins uniformly contain 16 per cent. of nitrogen. While this method of estimation is not strictly accurate it is as close an approximation as it is generally possible or practicable to get. From protein the

body repairs waste, builds new tissue and, to a lesser extent, derives heat and energy. It was formerly thought that all proteins were adequate for all these processes, but it is a comparatively recent contribution to our knowledge that they are not. Protein is a complex substance made up of nineteen separate parts called amino acids. Proteins which contain some of all the various amino acids are called "complete" proteins; those in which one or more amino acids are lacking are called "incomplete". Undoubtedly all these separate parts play some rôle in vital processes; more particularly we know that tryptophane and lysine are essential to a normal rate of growth. The proteins of cereal grains are relatively low in the two amino acids just mentioned while proteins of animal origin, such as milk, meat, and eggs, are rich in these two substances; thus the logic of supplementing grain rations with skimmed milk or tankage is apparent. Grain mixtures alone may suffice if fed in sufficient quantity but it may happen that the energy requirements of the animal will become satisfied by non-protein constituents of the ration and its appetite fail before enough of the necessary amino acids has been acquired.

Knowledge of digestible nutrients and nutritive ratios are not the final criteria by which rations are to be adjusted. The right kind and quality of protein must be supplied.

Crude Fiber. By this term is meant the coarser and more woody tissue characteristic of all forms of roughage and present in the outer coats of cereal and other fodder grains. It belongs to the carbohydrate group and is, in part, digested by ruminant animals. Its chief value lies in its mechanical effect in the intestinal tract.

Nitrogen-free Extract. In this class are included the relatively more digestible carbohydrates of the starch and sugar types. Their principal rôle in nutrition is to supply heat and energy, but they have also the power of sparing protein, by which is meant that when fed together with protein they reduce the amount of the latter food required. An excess of this carbohydrate group over the immediate needs of the body can be transformed into fat and stored in the body tissue.

The term "carbohydrate" as applied to a feeding stuff properly means "crude fiber" and "nitrogen-free extract" combined. Nitrogen-free extract is obtained by deducting from 100 per cent. the sum of the percentages of moisture, ash, protein, fiber and fat (ether extract).

Fat (Ether Extract). Fats, like the carbohydrates, furnish energy to the body and like them also, but to a lesser extent, spare protein. As energy producers their value is 2.25 times greater than that of either carbohydrate or protein. This ether-soluble material is in all cases crude fat, by which we understand that non-fatty substances like chlorophyll and coloring matter may be included therein.

Accessory Nutritive Factors. In this class are included the *vitamines.* There is not likely to be a deficiency of the vitamines A, B, and C in rations of domestic animals but the antirachitic vitamine by reason of its influence on the assimilation of calcium and phosphorus, as already noted, is of very practical importance. Green fodder or properly cured leguminous hay will supply this factor. The beneficial influence of sunlight upon the growth and development of animals has also been strikingly demonstrated, and it may be classed with the vitamines as an accessory nutritive factor.

DIGESTIBLE NUTRIENTS.

The gross amount of nutrient material taken into the animal body is probably never completely utilized. That portion of such material which actual feeding tests have shown is retained in the animal body, is taken to be the coefficient of digestibility of that material and is expressed in per cent.

Thus, for cottonseed meal it has been found that, on the average 85 per cent. of the protein, 37 per cent. of the fiber, 75 per cent. of the carbohydrates and 95 per cent. of the fat are digestible; or, in other words, out of each 100 parts of protein, of fiber, of carbohydrates and of fat that an animal eats, 85, 37, 75 and 95 parts, respectively, are retained in the body; i.e., not excreted. These figures are taken, therefore, to be the coefficients of digestibility for the several nutrients as they are found in cottonseed meal.

Coefficients of digestibility for some common commercial concentrates are given in the following table.

TABLE I. COEFFICIENTS OF DIGESTIBILITY OF FEEDING STUFFS.[1]

Feed.	Average dry matter, lbs. per hundred.	Coefficient of digestibility.			
		Protein.	Carbohydrate.		Fat.
			Fiber.	Nitrogen free extract.	
Cottonseed Meal	92.2	84	37	75	95
Cottonseed Feed	91.7	58	45	61	90
Linseed Meal (Old Process)	90.9	89	57	78	89
Wheat Bran	89.9	78	31	72	68
Wheat Middlings	89.6	77	30	78	88
Wheat Feed	89.9	77	36	76	87
Rye Feed	88.5	80	..	88	90
Buckwheat Middlings	88.0	87	32	86	83
Oat Feed	93.5	75	42	46	78
Oat Middlings	93.1	80	49	85	93
Corn Gluten Feed	91.3	85	76	88	85
Gorn Gluten Meal	90.9	85	55	90	93
Hominy Feed	89.9	66	76	90	91
Brewers' Grains	92.5	81	49	57	89
Dried Beet Pulp	91.8	52	83	83	..

[1]Henry and Morrison: Feeds and Feeding, 18th Ed.

INSPECTION AND ANALYSES.

Classification of Samples.

Commercial feeding stuffs and other fodder materials examined during the past year may be classified as follows:

Official samples drawn by the Station agent	201
Samples submitted by individuals or drawn by the Station agent on request	48
Samples examined for Storrs station	100
Samples examined for Department of Plant Breeding	3
Total	352

Official samples taken in course of the regular inspection are classified as follows:

Cottonseed Products	12	Maize Products	22
Linseed Products	6	Brewers' Products	2
Wheat Products	41	Dried Beet Pulp	5
Rye Products	2	Proprietary Stock Feeds	73
Wheat and Rye Products	1	Poultry Feeds	33
Buckwheat Products	2		
Oat Products	2	Total	201

Only official samples collected by the Station agent and those submitted by individuals are discussed in this report.

Remarks on Analyses.

(*Analyses in Table III, pages 336-355*).

The definitions of feeding stuffs here given are those adopted by the Association of Feed Control Officials as revised to November, 1923.

Samples were collected in November and December of 1923 and prices, where given, are those quoted at that time.

COTTONSEED MEAL.

41.12 Per cent. Protein Cottonseed Meal, Choice Quality, must be finely ground, not necessarily bolted, perfectly sound and sweet in odor, yellow, free from excess of lint, and by analysis must contain at least 41.12 per cent. crude protein, equivalent to 8 per cent. of ammonia.

Cotton seed meal not fulfilling the above requirements as to color, odor, or texture, shall be branded Off Quality.

38.56 Per cent. Protein Cottonseed Meal, Prime Quality, must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color, yellow, not brown or reddish, free from excess of lint, and by analysis must contain at least 38.56 per cent. crude protein, equivalent to 7.5 per cent. of ammonia.

Cottonseed meal not fulfilling the above requirements as to color, odor or texture, shall be branded Off Quality.

36 Per Cent. Protein Cottonseed Meal, Good Quality, must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color, free from

excess lint and must contain at least 36 per cent. crude protein, equivalent to 7 per cent. of ammonia.

Cottonseed Meal not fulfilling the above requirements as to color, odor or texture, shall be branded Off Quality.

Eleven samples were examined, two of which, **22135** and **22004,** were deficient in protein by more than 1 per cent. One, **22013,** had the tags secured by wire which is illegal.

The average composition as regards protein, fiber and fat was 37.9 per cent., 11.2 per cent. and 6.4 per cent., in the order named. The average cost per ton was $56.18.

In the inspection a year ago it was shown that protein was purchased at better advantage in 43 per cent. meal, 14.4 pounds of protein being purchased for $1.00 in the first named grade as compared with 12.5 pounds in the last named grade. A similar comparison this year shows for 43 per cent. meal 14.4 pounds and for 36 per cent. meal 13.3 pounds. Again the comparison favors the highest grade; the data, however, are based upon a rather limited number of samples, particularly of the 43 per cent. group.

COTTONSEED FEED.

Cottonseed Feed is a mixture of cottonseed meal and cottonseed hulls containing less than 36 per cent. protein.

One sample, *White Mule* brand, was guaranteed to contain 36 per cent. of protein and 39 per cent. was found; in other respects also the guaranty was exceeded.

LINSEED MEAL.

Linseed Cake or Meal is oil cake or meal made from flaxseed, provided that the final product shall contain less than 6 per cent. of weed seeds and other foreign materials and, provided, further that no portion of the stated 6 per cent. of weed seeds and other foreign materials shall be deliberately added.

Old Process Oil Meal, Old Process Linseed Meal is oil meal as defined or linseed meal as defined produced by crushing, cooking and hydraulic pressure.

The six samples examined satisfied their guaranties in all respects. One, **22176,** had tags secured by wire which is illegal.

The average protein content was 31.9 per cent. and the average cost per ton was $56.83. This is 2 per cent. less protein than was found last year and the price per ton is about $4.00 less.

WHEAT BRAN.

Wheat Bran is the coarse outer coating of the wheat kernel as separated from cleaned and scoured wheat in the usual process of commercial milling.

Nineteen samples of wheat bran were examined. All substantially met or exceeded the guaranties for protein and no

excess lint and must contain at least 36 per cent. crude protein, equivalent to 7 per cent. of ammonia.

Cottonseed Meal not fulfilling the above requirements as to color, odor or texture, shall be branded Off Quality.

Eleven samples were examined, two of which, **22135** and **22004**, were deficient in protein by more than 1 per cent. One, **22013**, had the tags secured by wire which is illegal.

The average composition as regards protein, fiber and fat was 37.9 per cent., 11.2 per cent. and 6.4 per cent., in the order named. The average cost per ton was $56.18.

In the inspection a year ago it was shown that protein was purchased at better advantage in 43 per cent. meal, 14.4 pounds of protein being purchased for $1.00 in the first named grade as compared with 12.5 pounds in the last named grade. A similar comparison this year shows for 43 per cent. meal 14.4 pounds and for 36 per cent. meal 13.3 pounds. Again the comparison favors the highest grade; the data, however, are based upon a rather limited number of samples, particularly of the 43 per cent. group.

COTTONSEED FEED.

Cottonseed Feed is a mixture of cottonseed meal and cottonseed hulls containing less than 36 per cent. protein.

One sample, *White Mule* brand, was guaranteed to contain 36 per cent. of protein and 39 per cent. was found; in other respects also the guaranty was exceeded.

LINSEED MEAL.

Linseed Cake or Meal is oil cake or meal made from flaxseed, provided that the final product shall contain less than 6 per cent. of weed seeds and other foreign materials and, provided, further that no portion of the stated 6 per cent. of weed seeds and other foreign materials shall be deliberately added.

Old Process Oil Meal, Old Process Linseed Meal is oil meal as defined or linseed meal as defined produced by crushing, cooking and hydraulic pressure.

The six samples examined satisfied their guaranties in all respects. One, **22176**, had tags secured by wire which is illegal.

The average protein content was 31.9 per cent. and the average cost per ton was $56.83. This is 2 per cent. less protein than was found last year and the price per ton is about $4.00 less.

WHEAT BRAN.

Wheat Bran is the coarse outer coating of the wheat kernel as separated from cleaned and scoured wheat in the usual process of commercial milling.

Nineteen samples of wheat bran were examined. All substantially met or exceeded the guaranties for protein and no

deficiencies in fat or excesses of fiber were found. Two samples, **22102** and **22117**, had tags attached by means of wire.

The quality of the samples examined equals the average of other years, but the cost per ton is about $4.00 more than last year and nearly $12.00 in advance of the average price quoted two years ago.

WHEAT MIDDLINGS

Standard Middlings consists mostly of fine particles of bran, germ and very little of the fibrous offal obtained from the "tail of the mill." This product must be obtained in the usual commercial process of milling and shall not contain more than 9.5 per cent. crude fiber.

Flour Middlings shall consist of standard middlings and red dog flour combined in the proportions obtained in the usual process of milling and shall not contain more than 6.0 per cent. crude fiber.

Red Dog Flour consists of a mixture of low-grade flour, fine particles of bran and the fibrous offal from the "tail of the mill" and shall not contain more than 4.0 per cent. crude fiber.

Brown Shorts (*Red Shorts*) consists mostly of the fine particles of bran, germ and very little of the fibrous offal obtained from the "tail of the mill". This product must be obtained in the usual commercial process of milling.

Gray Shorts (*Gray Middlings* or *Total Shorts*) consists of the fine particles of the outer bran, the inner bran or bee-wing bran, the germ and the offal or fibrous materials obtained from the "tail of the mill." This product must be obtained in the usual process of commercial milling.

White Shorts or *White Middlings* consists of a small portion of the fine bran particles and the germ and a large portion of the fibrous offal obtained from the "tail of the mill." This product must be obtained in the usual process of flour milling.

Brown shorts, gray shorts and white shorts are further differentiated on the basis of fiber contents, tentative limits for which have been set at 6.5, 5.5 and 3.5 per cent. for the classes in the order named.

Standard middlings differ from brown shorts (red shorts), in that the latter have less fiber; 3 per cent. less according to the tentative fiber limits which have been adopted.

None of the samples exceeded the limits of fiber set for standard middlings. In many cases the fiber is low enough to classify them as shorts although the labels seldom declare such grade. Protein and fat guaranties were met or exceeded in all cases. The average composition for this group of feeds is protein 17.3 per cent., fiber 6.1 per cent. and fat 5.5 per cent. The average ton price is about $5.00 in advance of that quoted in the previous inspection.

MIXED FEED.

Wheat Mixed Feed (*Mill Run Wheat Feed*) consists of pure wheat bran and the gray or total shorts or flour middlings combined in the proportions obtained in the usual process of commercial millings.

The tentative limits for fiber content of mixed feed in 8.5 per cent.; and for hard wheat mixed feed 9.5 per cent.

The average fiber content for this group as shown by analyses was 7.1 per cent. and no single sample exceeded 8.5 per cent. No deficiencies in protein or in fat were found. The average composition was found to be protein 16.3 per cent., fiber 7.1 per cent. and fat 5.4 per cent. An increase in price of about $4.00 per ton is noted as compared with the inspection a year ago.

RYE PRODUCTS.

Rye Middlings or *Rye Feed* is the by-product obtained from the manufacture of ordinary "100 per cent." rye flour from cleaned and scoured rye grain.

Two samples of rye middlings were examined both of which satisfied their guaranties in all respects.

WHEAT AND RYE PRODUCTS.

A sample of the mixed middlings of wheat and rye was found to fully conform to its guaranty.

BUCKWHEAT PRODUCTS.

Buckwheat Shorts or *Buckwheat Middlings* are that portion of the buckwheat grain immediately inside of the hull after separation from the flour.

Two samples were examined one of which was described as consisting of middlings, buckwheat hulls and buckwheat screenings. This last named feed was high in fiber, as might be expected, but did not exceed the limit of fiber declared. The sample of buckwheat middlings, **22148**, was without a statement of guaranty.

OAT PRODUCTS.

Oat Middlings are the floury portions of the oat groat (kernel), obtained in the milling of rolled oats.

Oat Shorts are the covering of the oat grain lying immediately inside the hull, being a fuzzy material carrying with it considerable portions of the fine floury part of the groat obtained in the milling of rolled oats.

Two samples were examined. One, *Corno*, was described as a mixture of oat middlings, oat shorts and oat hulls.

Both samples conformed to their guaranties.

CORN GLUTEN FEED.

Corn Gluten Feed is that portion of commercial shelled corn that remains after the separation of the larger part of the starch and the germs by the processes employed in the manufacture of cornstarch and glucose. It may or may not contain corn solubles.

Five samples were examined and all substantially equalled or exceeded their guaranties for protein and fat. The average price per ton, $55.20, is about $6.00 higher than quoted a year ago.

CORN GLUTEN MEAL.

Corn Gluten Meal is that part of commercial shelled corn that remains after the separation of the larger part of the starch, the germ and the bran, by the processes employed in the manufacture of cornstarch and glucose. It may or may not contain corn solubles.

The one sample examined considerably exceeded the guaranty for protein and fat.

HOMINY FEED.

Hominy Feed, Hominy Meal or Hominy Chop is the kiln-dried mixture of the mill run bran coating, the mill run germ, with or without a partial extraction of the oil and a part of the starchy portion of the white corn kernel obtained in the manufacture of hominy, hominy grits and corn meal by the degerminating process.

Sixteen samples were analyzed and no deficiencies in protein or excesses of fiber were found. Five samples showed deficiencies in ether extract (crude fat), greater than 0.25 per cent. One sample, **22175**, bore tags attached by means of wire.

BREWERS' GRAINS.

Brewers' Dried Grains are the properly dried residue from cereals obtained in the manufacture of beer.

Two samples were examined one of which, **22067**, was 1.12 per cent. low in protein.

DRIED BEET PULP.

Dried Beet Pulp is the dried residue from sugar beets which have been cleaned and freed from crowns, leaves and sand, and which have been extracted in the process of manufacturing sugar.

Five samples were examined all of which satisfied the requirements of their guaranties.

PROPRIETARY MIXED FEEDS.

These feeds aim to supply ready mixed so-called balanced rations for the various classes of farm animals. Some, no doubt, are compounded carefully and with the best available information of feed values. Chemical analyses will furnish data as to the gross amounts of the several nutrients from which may be estimated the digestible nutrients; but only feeding practice will demonstrate the quality of the nutrients.

A study of the analyses tabulated under the heading of "Horse, Dairy and Stock Feeds", p. 346, shows that there are, exclusive of three calf meals, seventy samples which may be divided into three nearly equal groups on the basis of their protein content, viz., 10 per cent., 20 per cent. and 25 per cent. As there are only four samples which would fall in a 15 per cent. group no separate classification was made for these, but they were placed in the 10

per cent. or the 20 per cent. groups. The 10 per cent. group includes feeds of protein content ranging roughly from 8 to 14 per cent.; the 20 per cent. group ranges from 17 to 22 per cent.; and the 25 per cent. group includes all those having above 22 per cent. of protein.

The average composition of each of these three groups as regards protein, nitrogen-free extract and fat and the average price per ton is given in the following summary:

AVERAGE PERCENTAGES OF NUTRIENTS AND PRICES PER TON IN THREE GROUPS OF PROPRIETARY FEEDS.

Group	No. of Samples.	Protein.	Nitrogen-free Extract.	Fat.	Price Per Ton.
Protein 10 per cent.	26	10.11%	63.92%	4.22%	$44.52
Protein 20 per cent.	23	19.60	53.62	5.08	51.27
Protein 25 per cent.	21	24.16	48.85	5.29	53.76

On the basis of amounts of nutrients secured for one dollar in each of these three groups the following comparison can be made.

NUTRIENTS FOR ONE DOLLAR IN THREE GROUPS OF PROPRIETARY FEEDS.

Group	Protein. lbs.	Nitrogen-free extract. lbs.	Fat. lbs.
Protein 10 per cent.	4.5	28.3	1.9
Protein 20 per cent.	7.7	20.9	2.0
Protein 25 per cent.	9.0	18.2	2.0

These comparisons are based upon the gross amounts of nutrients. By reason of the miscellaneous sources from which the nutrients in proprietary feeds are derived and the difficulty in ascertaining the exact proportions of the ingredients, digestible nutrients cannot be accurately computed. The comparative figures given show that the price per ton increases as the protein content of the feed increases; protein is the most expensive of the nutrients. Fat does not vary greatly in the three groups and the amounts secured for the unit price are practically identical. For the same amount of money the feeder secures in the 20 per cent. protein group two-thirds more protein and one-fourth less nitrogen-free extract than in the 10 per cent. protein group; in the 25 per cent. protein group he secures twice as much protein and one-third less nitrogen-free extract than in the 10 per cent. protein group. So far as protein is concerned the lowest priced feeds are, on the average, its most expensive source.

SUMMARY OF DEFICIENCIES.

In Table II is given a summary of those feeds which were found not to meet the requirements of their guaranties or were otherwise illegal. Only variations from guaranty greater than 1 per cent. in protein and fiber and 0.25 per cent. in fat are noted.

TABLE II. FEEDS NOT CONFORMING TO GUARANTIES OR OTHERWISE ILLEGAL.

Station No.	Manufacturer and Brand	Protein Deficiency	Fat Deficiency	Fiber Excess	Remarks
	COTTONSEED MEAL.	%	%	%	
22135	Paramount. Ashcraft-Wilkinson Co., Atlanta, Ga.	1.50	....	....	....
22004	Good. The Cameron-Daniel Co., Atlanta, Ga.	1.25	....	....	....
22013	Buckeye. Buckeye Cotton Oil Co., Cincinnati, Ohio	....	....	....	Wire tags, illegal.
	LINSEED MEAL.				
22176	Kellogg & Miller, Amsterdam, N. Y.	....	....	....	Wire tags, illegal.
	WHEAT BRAN.				
22102	Larabee Flour Mills Corp., Wellington, Kansas	....	....	....	Wire tags, illegal.
22117	Leavenworth Milling Co., Leavenworth, Kansas	....	....	....	Wire tags, illegal.
	HOMINY FEED.				
22030	Acme. Acme Evans Co., Indianapolis, Ind	....	1.04	....	....
22120	Badger. Chas. A. Krause Milling Co., Milwaukee, Wis	....	0.27	....	....
22002	Sonny South. Louisville Milling Co., Louisville, Ky	....	0.90	....	....
22175	Patent Cereals Co., Geneva, N. Y.	....	0.32	....	Wire tags, illegal.
22162	Paragon. Chas. M. Cox, Boston, Mass	....	1.13	....	....
	BREWER'S PRODUCTS.				
22067	Bull. Farmers' Feed Co., New York City	1.12	....	....	....
	PROPRIETARY MIXED FEEDS.				
22021	Portage Stock Feed. Akron Feed & Milling Co., Akron, Ohio	....	0.50	1.41	....
22147	Direct Stock Feed. Thomas-Boyce Feed Co., Attica, N. Y.	....	1.43	....	....
22168	Nobotheration Stock Feed. C. W. Campbell Co., Westerly, R. I.	....	1.62	....	....
22185	Davis Stock Feed. R. G. Davis & Sons, New Haven, Conn.	1.87	1.79	....	....

TABLE II. FEEDS NOT CONFORMING TO GUARANTIES OR OTHERWISE ILLEGAL—*Concluded.*

Station No.	Manufacturer and Brand	Protein Deficiency	Fat Deficiency	Fiber excess	Remarks
	PROPRIETARY MIXED FEEDS—Concluded.	%	%	%	
22079	Milkmore Dairy Ration. Eastern States Farmers' Exchange, Springfield, Mass.	....	0.89	....	....
22121	Elmore Milk Grains. Elmore Milling Co., Oneonta, N. Y.	....	0.85	....	....
22023	Algrane Milk Feed. H-O Cereal Co., Inc., Buffalo, N. Y.	....	0.63	....	....
22058	Red Star Dairy Feed. E. Manchester & Sons, Winsted, Conn.	2.87	....	....	....
22108	Red Wing Dairy Ration. Meech & Stoddard, Inc., Middletown, Conn.	3.87	....	....	....
22131	Red Wing Junior Dairy Ration. Meech & Stoddard, Inc., Middletown, Conn.	2.12	0.73	....	....
22134	Red Wing Stock Feed. Meech & Stoddard, Inc., Middletown, Conn.	....	....	2.47	....
22183	Red Wing Junior Dairy Ration. Meech & Stoddard, Inc., Middletown, Conn.	1.81	0.62	....	....
22115	Ryde's Cream Calf Meal. Ryde & Company, Chicago, Ill.	....	0.85	....	....
22145	Mill Stream Boomerang Dairy Feed. Winchell Smith, Farmington, Conn.	5.62	1.23	....	....
22075	Iowa Stock Feed. Purity Oats Co., Chicago, Ill.	....	0.59	....	....
22140	Quisenberry "Big 4" Laying Mash. Quisenberry Feed Mfg. Co., Buffalo, N. Y.	....	....	1.65	....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	OIL SEED PRODUCTS.	
	Cottonseed Meal.	
22011	Good. E. T. Allen Co., Atlanta, Ga.....	*Waterbury.* Spencer Grain Co..
		Guaranty....................
22187	Rainbow. American Oil Cake & Feed Co. Dallas, Texas.......................	*New Haven:* R. G. Davis & So
		Guaranty..................
22135	Paramount. Ashcraft-Wilkinson Co., Atlanta, Ga........................	*Middletown:* Meech & Stoddar(
		Guaranty..................
22013	[1]Buckeye. Buckeye Cotton Oil Co., Cincinnati, Ohio......................	*West Cheshire:* G. W. Thorpe..
		Guaranty..................
22004	Good. The Cameron-Daniel Co., Atlanta, Ga..............................	*Seymour:* Seymour Grain & Co
		Guaranty..................
22066	Bull. Humphreys-Godwin Co., Memphis, Tenn............................	*New Milford:* Geo. I. Soule...
		Guaranty..................
22049	Danish. Humphreys-Godwin Co., Memphis, Tenn.........................	*Canaan:* Ives & Pierce........
		Guaranty..................
22157	Lovit. L. B. Lovitt & Co., Memphis, Tenn............................	*Rockville:* Rockville Grain & Cc
		Guaranty..................
22084	Thirty-six. L. B. Lovitt & Co., Memphis, Tenn............................	*Hamden:* I. W. Beers.........
		Guaranty..................
22149	Triangle. R. N. Neal & Co., Memphis, Tenn............................	*New Hartford:* Geo. W. Case..
		Guaranty..................
22044	Prime Quality. Texas Refining Co., San Antonio, Texas.....................	*Torrington:* Litch. Co. Co-op. A
		Guaranty..................
		Average guaranty............
		Average of analyses...........
		Average digestible............
	Cottonseed Feed.	
22092	White Mule. Marianna Cotton Oil Co., Marianna, Ark......................	*Bristol:* Goodsell Bros.........
		Guaranty..................
	Linseed Meal, Old Process.	
22041	Amco. American Milling Co., Peoria, Ill..................................	*Torrington:* D. L. Talcott.....
		Guaranty..................
21993	Archer Daniels Linseed Co., Edgewater, N. J..............................	*Derby:* Peterson-Hendee Co...
		Guaranty..................
22176	[1] Kellogg & Miller, Amsterdam, N. Y......	*Danielson:* Quinnibaug Mills...
		Guaranty..................
22010	Kellogg's. Kellogg & Sons, Buffalo, N. Y.	*Waterbury:* Spencer Grain Co..
		Guaranty..................
22093	Argentine. Mann Bros. Co., Buffalo, N. Y.	*Bristol:* Goodsell Bros.........
		Guaranty..................
22186	Midland Linseed Products Co., Edgewater, N. J........................	*New Haven:* R. G. Davis & So:
		Guaranty..................
		Average guaranty............
		Average of analyses...........
		Average digestible............

[1] Wire tags.

INSPECTION OF 1923.

Station No.	Pounds per Hundred						Price per ton
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
22011	6.82	5.95	36.25	11.87	31.95	7.16	$55.00
.....	....	....	36.00	14.00	....	5.50	.....
22187	7.58	5.82	36.38	12.03	31.82	6.37	54.00
.....	....	....	36.00	.....	....	5.00	.....
22135	6.92	5.57	34.50	13.33	34.15	5.53	54.00
.....	....	....	36.00	14.00	.....	5.50	.....
22013	6.68	6.30	36.00	12.09	33.14	5.79	53.00
.....	....	....	36.00	.....	.....	5.00	.....
22004	8.21	6.08	34.75	11.19	32.82	6.95	55.00
.....	....	....	36.00	14.00	.....	5.50	.....
22066	8.00	6.18	42.88	7.19	28.65	7.10	60.00
.....	....	....	43.00	10.00	.....	5.00	.....
22049	7.13	5.81	36.75	12.24	31.94	6.13	55.00
.....	....	....	36.00	15.00	.....	5.00	.....
22157	6.48	6.78	41.31	8.78	30.17	6.48	64.00
.....	....	....	41.00	10.00	.....	6.00	.....
22084	6.88	6.23	39.25	10.05	31.24	6.35	56.00
.....	....	....	36.00	14.00	.....	5.00	.....
22149	6.20	5.92	36.50	12.08	33.09	6.21	54.00
.....	....	....	36.00	14.00	.....	5.00	.....
22044	6.78	5.29	42.13	12.00	28.03	5.77	58.00
.....	....	....	43.00	12.00	.....	6.00	.....
.....	....	....	**37.73**	**13.00**	.....	**5.32**	.....
.....	**7.06**	**5.99**	**37.88**	**11.17**	**31.55**	**6.35**	**56.18**
.....	....	....	**32.7**	**4.1**	**23.7**	**6.0**	.....
22092	6.45	6.05	39.00	10.53	31.48	6.49	55.00
.....	....	....	36.00	14.00	28.50	5.00	.....
22041	8.53	5.90	30.44	8.78	39.84	6.51	53.00
.....	....	....	30.00	.....	.....	5.00	.....
21993	8.88	6.03	33.19	6.98	37.71	7.21	58.00
.....	....	....	31.00	.....	.....	5.00	.....
22176	7.67	6.27	30.94	6.85	40.89	7.38	63.00
.....	....	....	30.00	9.00	.....	4.00	.....
22010	7.45	6.12	32.38	7.30	40.17	6.58	55.00
.....	....	....	31.00	.....	.....	5.00	.....
22093	8.61	5.95	31.69	7.44	37.90	8.41	58.00
.....	....	....	31.00	10.00	.....	6.00	.....
22186	7.04	6.17	32.50	7.33	40.04	6.92	54.00
.....	....	....	32.00	.....	.....	5.00	.....
.....	....	....	**30.83**	**9.50**	.....	**5.00**	.....
.....	**8.03**	**6.07**	**31.86**	**7.45**	**39.43**	**7.17**	**56.83**
.....	....	....	**28.4**	**4.3**	**30.8**	6.4	.....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	WHEAT PRODUCTS.	
	Wheat Bran.	
22125	Chas. M. Cox & Co., Boston, Mass......	*East Haven:* F. A. Forbes....
		Guaranty.................
22060	[2]Lucky. Federal Mill & Elevator Co., Lockport, N. Y....................	*Torrington:* F. L. Wadhams &
		Guaranty..................
21994	[2]Wm. Hamilton & Son, Inc., Honeoye Falls, N. Y........................	*Derby:* Peterson-Hendee Co..
		Guaranty.................
22129	[2]Wm. Hamilton & Son, Inc., Honeoye Falls, N. Y........................	*Guilford:* Fred C. Morse.....
		Guaranty.................
22038	[2]Choice. Hecker-Jones-Jewell Milling Co., New York..........................	*Waterbury:* H. S. Coe & Co...
		Guaranty.................
22107	[2]Choice. Hecker-Jones-Jewell Milling Co., New York..........................	*Meriden:* Meriden Grain & Co
		Guaranty.................
22102	[1,2]Larabee Flour Mills Corp, Wellington, Kansas............................	*Wallingford:* A. E. Hall......
		Guaranty..................
22117	[1,2]Leavenworth Milling Co., Leavenworth, Kansas............................	*Granby:* E. H. Rollins.......
		Guaranty.................
22000	Niagara. Niagara Falls Milling Co., Niagara Falls, N. Y.................	*Ansonia:* Ansonia Flour & Gr
		Guaranty..................
22062	Ogilvie Flour Mills Co., Fort William, Canada...........................	*Litchfield:* Wadhams & Co...
		Guaranty.................
22051	Bell Cow. Quaker Oats Co., Chicago, Ill.	*Canaan:* Ives & Pierce.......
		Guaranty.................
22190	Royal. Royal Milling Co., Great Falls, Mont.............................	*New Haven:* Crittenden-Benha
		Guaranty.................
22073	Occident. Russell Miller Milling Co., Minneapolis, Minn.................	*Danbury:* H. E. Meeker
		Guaranty.................
22114	Dakota Maid. State Mill & Elevator Co., Grand Forks, North Dakota..........	*Willimantic:* Willimantic Grai
		Guaranty.................
22078	[2]Crescent. Star & Crescent Milling Co., Chicago, Ill......................	*Norwalk:* Francis H. Leggett &
		Guaranty.................
22019	St. Laurance Flour Milling Co., Montreal, Canada...........................	*Southport:* C. Buckingham & C
		Guaranty.................
22032	[2]Angelus. Thompson Milling Co., Lockport, N. Y..........................	*Stamford:* Francis H. Leggett &
		Guaranty..................
22043	[2]Gold Medal. Washburn-Crosby Co., Minneapolis, Minn....................	*Torrington:* D. L. Talcott....
		Guaranty.................
22008	Pioneer. Western Canada Flour Mills Co., Winnipeg, Canada..............	*Waterbury:* Spencer Grain Co.
		Guaranty.................
		Average guaranty...........
		Average of analyses..........
		Average digestible...........
	Wheat Middlings.	
22124	C. M. Cox & Co., Boston, Mass.........	*East Haven:* F. A. Forbes....
		Guaranty.................
22127	Wirthmore. C. M. Cox & Co., Boston, Mass.............................	*Branford:* S. V. Osborn......
		Guaranty.................

[1] Wire tags.
[2] With screenings.

INSPECTION OF 1923—*Continued.*

Station No.	Pounds per Hundred: Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	Price per ton
22125	10.07	5.82	16.06	8.63	53.36	6.06	$38.00
.....	....	....	.....	.....	.....	....	....
22060	8.73	6.73	14.75	9.82	54.59	5.38	41.00
.....	....	....	15.00	.....	.....	4.00	.....
21994	9.96	6.45	15.25	8.06	56.02	4.26	42.00
.....	....	....	13.25	11.60	.....	2.90	....
22129	9.43	5.95	14.75	8.68	56.83	4.36	44.00
.....	....	....	13.25	11.60	.....	2.90	.....
22038	10.21	6.18	14.50	9.63	54.26	5.22	41.00
.....	....	....	13.00	.....	.....	3.50	.....
22107	9.35	6.76	15.75	9.23	53.64	5.27	42.00
.....	....	....	13.00	14.00	.....	3.50	.....
22102	9.61	6.47	15.88	8.66	54.52	4.86	37.00
.....	....	....	15.00	10.00	.....	3.50	.....
22117	10.35	6.65	15.63	8.16	54.91	4.30	39.00
.....	....	....	14.50	10.00	.....	3.60	.....
22000	9.56	5.93	16.25	8.32	54.92	5.02	39.00
.....	....	....	15.00	.....	.....	3.50	.....
22062	9.36	6.22	16.06	8.23	54.07	6.06	42.00
.....	....	....	14.00	.....	.....	3.00	.....
22051	9.05	5.62	15.75	9.60	54.29	5.69	42.00
.....	....	....	15.00	.....	.....	3.50	.....
22190	8.99	5.88	17.25	7.88	53.82	6.18	38.00
.....	....	....	15.00	.....	.....	3.00	.....
22073	9.42	6.44	16.13	8.73	53.49	5.79	42.00
.....	....	....	14.00	.....	.....	4.00	.....
22114	10.43	6.08	15.25	9.34	52.70	6.20	39.00
.....	....	....	14.00	.....	.....	5.00	.....
22078	10.24	6.68	14.88	9.06	54.50	4.64	42.00
.....	....	....	14.00	.....	.....	3.00	.....
22019	8.12	6.08	16.19	9.08	54.98	5.55	40.00
.....	....	....	15.00	.....	.....	3.50	.....
22032	10.73	6.55	15.25	9.17	53.58	4.72	42.00
.....	....	....	15.50	.....	.....	4.00	.....
22043	9.14	5.88	16.13	9.13	54.43	5.29	43.00
.....	....	....	14.00	.....	.....	4.00	.....
22008	10.06	6.23	15.88	8.98	53.00	5.85	41.00
.....	....	....	15.00	.....	.....	3.50	.....
.....	....	....	**14.31**	**11.44**	.....	**3.55**	.....
.....	**9.62**	**6.24**	**15.66**	**8.86**	**54.32**	**5.30**	**40.74**
.....	....	....	**12.2**	**2.7**	**39.1**	**3.6**	.....
22124	10.06	4.10	18.44	5.73	54.87	6.80	38.00
.....	....	....	.....	.....	.....	....	.....
22127	10.18	3.60	17.00	5.16	58.80	5.26	44.00
.....	....	....	14.00	8.00	.....	4.00	.....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	WHEAT PRODUCTS—*Concluded.*	
	Wheat Middlings—Concluded.	
22056	[2]Commander. Commander Milling Co., Minneapolis, Minn.	*Winsted:* E. Manchester & Son
		Guaranty
22130	[2]Dominion Flour Mills Co., Montreal, Canada	*Guilford:* Fred C. Morse
		Guaranty
22119	Elmore Red Dog Flour Middlings. Elmore Milling Co., Oneonta, N. Y.	*Thompsonville:* Geo. S. Phelps
		Guaranty
22026	[2]H. Hecker-Jones-Jewell Milling Co., New York	*Stamford:* Francis H. Leggett &
		Guaranty
22109	Niagara. Niagara Falls Milling Co., Niagara Falls, New York	*Meriden:* H. Grulich
		Guaranty
22100	[2]Northwestern Consolidated Milling Co., Minneapolis, Minn.	*North Haven:* W. L. Thorpe
		Guaranty
22009	Bell Cow. Quaker Oats Co., Peterborough, Canada	*Waterbury:* Spencer Grain Co.
		Guaranty
22017	A. H. Randall Milling Co., Tekonsha, Michigan	*West Cheshire:* G. W. Thorpe
		Guaranty
22111	[2]Dakota. State Mill. & Elevator Co., Grand Forks, North Dakota	*New Britain:* S. Svea Grain & C
		Guaranty
21999	[2]Gold Medal. Washburn-Crosby Co., Minneapolis, Minn.	*Ansonia:* Ansonia Flour & Gra
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible
	Wheat Feed (Mixed Feed)	
22110	[2]St. Paul Queen. Capitol City Milling & Grinding Co., St. Paul, Minn.	*New Britain:* S. Svea Grain & C
		Guaranty
22158	Boston. Duluth Superior Milling Co., Duluth, Minn.	*Rockville:* Rockville Grain &, C
		Guaranty
22177	Durum. Duluth Superior Milling Co., Duluth, Minn.	*Danielson:* Dayville Grain & C
		Guaranty
22181	Dairy Maid. Federal Mill & Elevator Co., Lockport, N. Y.	*Putnam:* Bosworth Bros.
		Guaranty
22099	[2]Northwestern Consolidated Milling Co., Minneapolis, Minn.	*No. Haven.* W. L. Thorpe
		Guaranty
22005	[2]Fancy. Pillsbury Flour Mills, Minneapolis, Minn.	*Seymour:* Seymour Grain & C
		Guaranty
22072	Occident. Russell Miller Milling Co., Minneapolis, Minn.	*Danbury:* H. E. Meeker
		Guaranty
22001	Gold Mine. Sheffield King Milling Co., Minneapolis, Minn.	*Ansonia:* Ansonia Flour & Gra
		Guaranty
22047	[2]Syragold. Syracuse Milling Co., Syracuse, N. Y.	*Norfolk:* Aug. P. Curtis
		Guaranty
22059	[2]Gold Medal. Washburn-Crosby Mills, Minneapolis, Minn.	*Torrington:* F. L. Wadhams &
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible

[2] With Screenings.

INSPECTION OF 1923—*Continued.*

Station No.	Pounds per Hundred						Price per ton
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
22056	10.32	4.48	17.13	6.73	56.09	5.25	$45.00
.....	....	....	16.50	.....	.....	5.00	.....
22130	9.58	4.61	17.63	7.35	54.58	6.25	44.00
.....	....	....	16.00	.....	.....	5.00	.....
22119	10.67	3.05	15.94	3.69	62.18	4.47	49.00
.....	....	....	15.00	6.00	.....	4.00	.....
22026	7.78	4.66	16.81	8.08	57.63	5.04	.....
.....	....	....	14.00	9.50	.....	5.00	.....
22109	9.07	4.13	17.31	6.21	57.70	5.58	44.00
.....	....	....	15.50	.....	.....	4.00	.....
22100	9.23	3.78	17.06	5.38	58.97	5.58	45.00
.....	....	....	15.00	.....	.....	4.00	.....
22009	8.59	3.94	17.50	5.94	57.82	6.21	41.00
.....	....	....	16.00	8.00	.....	4.00	.....
22017	7.64	4.96	18.13	6.35	58.40	4.52	42.00
.....	....	....	13.00	12.00	.....	3.00	.....
22111	10.45	3.83	17.63	5.31	56.89	5.89	44.00
.....	....	....	16.10	.....	.....	5.70	.....
21999	9.69	4.55	17.06	6.72	56.68	5.30	39.00
.....	....	....	15.00	.....	.....	4.00	.....
.....	....	....	**15.10**	**8.70**	.....	**4.34**	.....
.....	**9.44**	**4.14**	**17.30**	**6.05**	**57.56**	**5.51**	**43.18**
.....	....	....	**13.3**	**1.8**	**44.9**	**4.8**	.....
22110	9.47	3.65	15.69	6.75	58.61	5.83	44.00
.....	....	....	15.70	.....	.....	4.60	.....
22158	8.51	5.30	16.25	7.97	56.22	5.75	44.00
.....	....	....	15.00	.....	.....	3.50	.....
22177	9.31	4.59	16.63	7.24	56.00	6.23	36.00
.....	....	....	15.00	.....	.....	5.00	.....
22181	8.40	5.28	15.75	7.05	58.77	4.75	42.00
.....	....	....	13.00	.....	.....	4.00	.....
22099	9.03	4.73	16.25	7.10	57.11	5.78	43.00
.....	....	....	15.00	.....	.....	4.00	.....
22005	10.36	4.10	16.50	5.16	59.27	4.61	43.00
.....	....	....	15.00	.....	.....	4.00	.....
22072	9.53	5.13	17.25	7.25	54.99	5.85	44.00
.....	....	....	15.00	.....	.....	4.00	.....
22001	9.26	5.20	15.13	8.23	56.87	5.31	40.00
.....	....	....	15.00	.....	.....	4.50	.....
22047	8.98	4.63	16.63	7.42	56.56	5.78	41.00
.....	....	....	15.00	10.00	.....	4.00	.....
22059	9.79	5.02	16.44	6.31	58.03	4.41	45.00
.....	....	....	16.00	.....	.....	4.00	.....
.....	....	....	**14.97**	.....	.....	**4.16**	.....
.....	**9.26**	**4.76**	**16.25**	**7.05**	**57.25**	**5.43**	**42.20**
.....	....	....	**12.5**	**2.5**	**43.5**	**4.7**	.....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	RYE PRODUCTS.	
22103	Choice Rye Middlings. Miner-Hillard Mill. Co., Wilkes-Barre, Pa.	*Wallingford:* A. E. Hall Guaranty
22042	Gold Medal Rye Middlings. Washburn-Crosby Co., Minneapolis, Minn.	*Torrington:* D. L. Talcott Guaranty
	WHEAT AND RYE PRODUCTS.	
22055	Palmo Midds. Newsome Feed and Grain Co., Pittsburgh, Pa.	*Winsted:* E. Manchester & Sons Guaranty
	BUCKWHEAT PRODUCTS.	
22123	[3]Buckwheat Offal Feed. Larrowe Buckwheat Flour Corp., Cohocton, N. Y.	*East Haven:* F. A. Forbes Guaranty
22148	Buckwheat Middlings. Winchell Smith, Farmington, Conn.	*Farmington:* Winchell Smith Guaranty
	OAT PRODUCTS.	
22160	Corno Oat Feed. Corno Mills Co., East St. Louis, Ill.	*Rockville:* Rockville Grain & Coa[l] Guaranty
22053	Oat Middlings. Armour Grain Co., Chicago, Ill.	*Winsted:* E. Manchester & Sons Guaranty
	MAIZE PRODUCTS.	
	Corn Gluten Feed.	
22163	Clinton. Clinton Corn Syrup Refining Co., Clinton, Iowa	*New London:* P. Schwartz Co. Guaranty
22089	Buffalo. Corn Products Refining Co., New York	*Plantsville:* C. A. Cowles Guaranty
22083	KKK. J. C. Hubinger Bros Co., Keokuk, Iowa	*Hamden:* I. W. Beers Guaranty
22061	Douglas. Penick & Ford, Ltd., Inc., Grand Rapids, Mich.	*Litchfield:* Wadhams & Co. Guaranty
21995	Staley's. A. E. Staley Mfg. Co., Decatur, Ill.	*Derby:* Peterson-Hendee Co. Guaranty Average guaranty Average of analyses Average digestible
	Corn Gluten Meal.	
22170	Diamond. Corn Products Refining Co., New York	*Westerly:* C. W. Campbell Co. Guaranty
	Hominy Feed.	
22030	Acme. Acme Evans Co., Indianapolis, Ind.	*Stamford:* Francis H. Leggett & C[o] Guaranty
22022	[4]Akron Feed & Milling Co., Akron, Onio.	*So. Norwalk:* Roodner Feed Co. Guaranty
22054	Homco. American Hominy Co., Indianapolis, Ind.	*Winsted:* E. Manchester & Sons Guaranty
22045	Yellow. Armour Grain Co., Chicago, Ill.	*Torrington:* Litch. Co. Coop. Ass[n] Guaranty

[3] Contains middlings, hulls and screenings from buckwheat.

INSPECTION OF 1923—*Continued.*

Station No.	Pounds per Hundred						Price per ton
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
22103	10.40	3.15	14.63	3.31	65.53	2.98	$41.00
.....	....	....	12.00	5.00	.....	2.50	.....
22042	9.30	4.57	14.94	6.06	61.62	3.51	41.00
.....	....	....	14.00	.....	.....	3.00	.....
22055	6.27	5.07	16.69	6.00	58.69	7.28	36.00
.....	....	....	16.00	9.00	....	7.00	.....
22123	8.89	4.03	10.13	18.09	54.84	4.02	41.00
.....	....	....	10.00	30.00	.....	2.25	.....
22148	10.46	2.76	15.81	5.00	61.79	4.18	45.00
.....	....	....	.....	.....	.....	....	.....
22160	4.78	6.23	7.88	22.57	56.13	2.41	25.00
.....	....	....	6.00	28.00	.....	2.00	.....
22053	6.45	3.20	16.63	5.94	61.68	6.10	47.00
.....	....	....	15.00	10.00	.....	5.00	.....
22163	8.29	3.64	25.25	5.72	53.81	3.29	53.00
.....	....	....	23.00	.....	.....	2.00	.....
22089	7.77	4.83	26.25	6.65	49.44	5.06	55.00
.....	....	....	23.00	.....	.....	1.00	.....
22083	8.59	2.03	22.75	6.62	56.40	3.61	53.00
.....	....	....	23.00	.....	.....	1.00	.....
22061	7.77	4.03	29.06	5.49	50.49	3.16	57.00
.....	....	....	23.00	.....	.....	1.00	.....
21995	8.88	4.77	27.69	4.97	52.03	1.66	58.00
.....	....	....	23.00	.....	.....	1.00	.....
.....	....	....	**23.00**	.....	.....	1.20	.....
.....	**8.26**	**3.86**	**26.20**	**5.89**	**52.43**	**3.36**	**55.20**
.....	....	....	**22.3**	**4.5**	**46.1**	**2.9**	.....
22170	8.62	1.04	42.19	2.19	43.02	2.94	66.00
.....	....	....	40.00	.....	.....	1.00	.....
22030	10.56	1.95	10.63	3.23	67.67	5.96	50.00
.....	....	....	10.00	6.00	.....	7.00	.....
22022	7.22	2.51	11.88	4.23	66.34	7.82	47.00
.....	....	....	.....	.....	.....	....	.....
22054	8.29	2.17	10.25	4.28	68.14	6.87	49.00
.....	....	....	10.00	6.00	.....	6.00	.....
22045	10.47	2.57	11.13	4.27	64.49	7.07	49.00
.....	....	....	9.50	5.00	.....	5.00	.....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	MAIZE PRODUCTS—*Concluded.*	
	Hominy Feed—Concluded.	
22014	Aunt Jemima Mills Co., St. Joseph, Mo. .	*West Cheshire:* G. W. Thorpe.
		Guaranty. . . . .
22162	Paragon. Chas. M. Cox, Boston, Mass.	*Chester:* Leet Bros. . . . .
		Guaranty. . . . .
22118	Emco. Evans Milling Co., Indianapolis, Ind.	*Suffield:* Spencer Bros. . . . . . .
		Guaranty. . . . .
22172	The Forbes Milling Co., Topeka, Kansas. .	*Norwich:* Yantic Grain & Prodı
		Guaranty. . . . .
22120	Badger. Chas. A. Krause Milling Co., Milwaukee, Wis.	*Thompsonville:* Geo. S. Phelps
		Guaranty. . . . .
22002	Sonny South. Louisville Milling Co., Louisville, Ky.	*Seymour:* Seymour Grain & Co
		Guaranty. . . . .
22133	Choice Steam Cooked. Miner-Hillard Milling Co., Wilkes-Barre, Pa.	*Middlefield:* Middlefield Gr. &
		Guaranty. . . . .
22175	[1]Patent Cereals Co., Geneva, N. Y.	*Moosup:* T. E. Main & Sons. .
		Guaranty. . . . .
22007	Pure. Plymouth Milling Co., Lemars, Iowa.	*Waterbury:* Spencer Grain Co.
		Guaranty. . . . .
22048	Burt's. Postum Cereal Co., Inc., Battle Creek, Mich.	*Norfolk:* Aug. P. Curtis. . . . . .
		Guaranty. . . . .
22039	Yellow. Quaker Oats Co., Chicago, Ill. . .	*Waterbury:* H. S. Coe & Co. . .
		Guaranty. . . . .
22126	White. Quaker Oats Co., Peterborough, Canada.	*Branford:* S. V. Osborn. . . . . . .
		Guaranty. . . . .
		Average guaranty. . . . .
		Average of analyses. . . . .
		Average digestible. . . . .
	BREWER'S PRODUCTS.	
22067	Bull. Farmers' Feed Co., New York City	*New Milford:* Geo. T. Soule. .
		Guaranty. . . . .
22153	Dried Grains. Dawes Brewery, Montreal, Quebec.	*Hazardville:* A. D. Bridges' So
		Guaranty. . . . .
	DRIED BEET PULP.	
22028	Great Western Sugar Co., Denver, Col. . .	*Stamford:* Francis H. Leggett
		Guaranty. . . . .
22132	Great Western Sugar Co., Denver, Col. . .	*Middlefield:* Middlefield Gr. &
		Guaranty. . . . .
22137	Great Western Sugar Co., Denver, Col. . .	*Middletown:* Meech & Stoddar
		Guaranty. . . . .
21997	Larrowe Milling Co., Detroit, Mich.	*Derby:* Peterson-Hendee Co. . .
		Guaranty. . . . .
22154	Mich. Sugar Co., Saginaw, Mich.	*Hazardville:* A. D. Bridges Soı
		Guaranty. . . . .
		Average guaranty. . . . .
		Average of analyses. . . . .
		Average digestible. . . . .

[1] Wire tags.

INSPECTION OF 1923—*Continued.*

Station No.	Pounds per Hundred						Price per ton
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
22014	9.72	2.28	10.25	5.73	66.04	5.98	$48.0
.....	....	....	10.00	6.00	.....	5.00	....
22162	9.39	2.39	10.50	3.43	67.92	6.37	49.0
.....	....	....	9.50	7.00	.....	7.50	....
22118	9.72	2.53	10.81	4.19	65.18	7.57	49.0
.....	....	....	10.00	7.00	.....	7.50	....
22172	6.18	2.70	11.00	5.61	65.83	8.68	45.0
.....	....	....	10.00	7.00	.....	8.00	....
22120	10.42	1.80	10.75	2.93	69.37	4.73	48.0
.....	....	....	10.00	.....	.....	5.00	....
22002	8.78	2.90	11.50	5.30	65.42	6.10	47.0
.....	....	....	10.00	6.00	.....	7.00	....
22133	9.46	2.35	10.75	3.88	68.21	5.35	45.0
.....	....	....	10.00	5.00	.....	4.00	....
22175	9.60	2.68	10.81	3.97	68.26	4.68	41.0
.....	....	....	10.00	5.00	.....	5.00	....
22007	7.77	2.29	11.19	4.08	67.31	7.36	49.0
.....	....	....	10.00	4.80	.....	6.30	....
22048	8.62	2.68	11.63	4.86	65.67	6.54	46.0
.....	....	....	10.00	5.00	.....	6.00	....
22039	8.89	2.30	11.38	3.61	67.99	5.83	48.0
.....	....	....	10.50	6.00	.....	5.00	....
22126	7.57	2.03	10.94	3.15	69.95	6.36	46.0
.....	....	....	10.50	5.00	.....	6.00	....
.....	....	....	**10.00**	**5.77**	.....	**6.02**	....
.....	**8.92**	**2.38**	**10.96**	**4.17**	**67.11**	**6.45**	**47.2**
.....	....	....	**7.2**	**3.2**	**60.4**	**5.9**	....
22067	4.58	4.03	20.88	16.22	46.47	7.82	50.0
.....	....	....	22.00	.....	.....	6.00	....
22153	5.71	3.67	23.88	12.16	46.41	8.17	52.0
.....	....	....	21.00	19.58	.....	6.25	....
22028	8.06	5.69	8.75	18.43	58.15	0.92	51.0
.....	....	....	8.00	20.00	.....	0.50	....
22132	7.12	3.08	8.50	19.58	61.09	0.63	49.0
.....	....	....	8.00	22.00	.....	....	....
22137	4.30	7.97	9.00	14.21	64.14	0.38	44.0
.....	....	....	8.00	.....	.....	0.50	....
21997	10.14	3.26	9.63	17.87	57.69	1.41	46.0
.....	....	....	8.00	20.00	.....	0.50	....
22154	6.60	2.93	9.50	19.32	61.04	0.61	51.0
.....	....	....	8.00	20.00	.....	0.50	....
.....	....	....	**8.00**	**20.50**	.....	**0.50**	....
.....	**7.24**	**4.59**	**9.08**	**17.88**	**60.42**	**0.79**	**48.2**
.....	....	....	**4.7**	**14.8**	**50.1**	....	....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	PROPRIETARY MIXED FEEDS. *Horse, Dairy and Stock Feeds.*	
22021	Portage Stock Feed. Akron Feed & Milling Co., Akron, Ohio	*So. Norwalk:* Roodner Feed Co Guaranty
21998	Sunshine Dairy Feed. Ansonia Flour and Grain Co., Ansonia, Conn	*Ansonia:* Ansonia Flour & Gra Guaranty
22033	Armour's Steam Cooked Feed. Armour Grain Co., Chicago, Ill	*Stamford:* W. L. Crabb Guaranty
22167	Favorite Dairy Ration. E. W. Bailey & Co., Swanton, Vt	*Mystic:* Mystic Grain Co Guaranty
22166	Pennant Brand Stock Feed. E. W. Bailey & Co., Swanton, Vt	*Mystic:* Mystic Grain Co Guaranty
22138	Blatchford's Calf Meal. Blatchford Calf Meal Co., Waukegan, Ill	*Middletown:* Meech & Stoddard Guaranty
22179	Parex Stock Feed. Bosworth Bros, Putnam, Conn	*Putnam:* Bosworth Bros Guaranty
22146	Direct Dairy Feed. Thomas-Boyce Feed Co., Attica, N. Y	*Farmington:* Winchell Smith Guaranty
22147	Direct Stock Feed. Thomas-Boyce Feed Co., Attica, N. Y	*Farmington:* Winchell Smith Guaranty
22164	Nobotheration Dairy Feed. C. W. Campbell Co., Westerly, R. I	*Mystic:* J. L. Manning & Co Guaranty
22168	Nobotheration Stock Feed. C. W. Campbell Co., Westerly, R. I	*Westerly:* C. W. Campbell Co Guaranty
22128	Paragon Dairy Feed. Chas. M. Cox Co., Boston, Mass	*Branford:* S. V. Osborn Guaranty
22015	Wirthmore Stock Feed. Chas. M. Cox Co., Boston, Mass	*West Cheshire:* G. W. Thorpe Guaranty
22068	Wirthmore Balanced Ration for Milch Cows. Chas. M. Cox Co., Boston, Mass.	*Danbury:* F. C. Benjamin Guaranty
22069	Ajax Dairy Ration. Chapin & Co., Hammond, Ind	*Danbury:* F. C. Benjamin Guaranty
22088	Unicorn Dairy Ration. Chapin & Co., Hammond, Ind	*Plantsville:* C. A. Cowles Guaranty
22098	Advanced Registry Dairy Feed. Clover Leaf Milling Co., Buffalo, N. Y	*North Haven:* W. L. Thorpe Guaranty
22101	Clover Leaf Stock Feed. Clover Leaf Milling Co., Buffalo, N. Y	*North Haven:* W. L. Thorpe Guaranty
22027	Fortune Stock Feed. Coles Company, Middletown, Conn	*Stamford:* Francis H. Leggett & Guaranty
22074	Basic Dairy Ration. R. G. Davis & Sons, New Haven, Conn	*Southford:* H. R. Stone Guaranty
22185	Davis Stock Feed. R. G. Davis & Sons, New Haven, Conn	*New Haven:* R. G. Davis & Soı Guaranty
22094	Delaware Dairy Feed. Delaware Mills, Deposit, N. Y	*Plainville:* Eaton Bros Guaranty
22079	Milkmore Dairy Ration. Eastern States Farmers' Exchange, Springfield, Mass	*New Canaan:* C. H. Fairty Co. Guaranty
22096	Fitting Ration. Eastern States Farmers' Exchange, Springfield, Mass	*Farmington:* C. E. Stephenson. Guaranty

INSPECTION OF 1923—*Continued.*

Station No.	Pounds per Hundred						Price per to
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
22021	6.09	3.97	8.25	11.41	66.78	3.50	$44.0
.....	....	....	8.50	10.00	.....	4.00	....
21998	9.19	5.22	20.50	7.11	52.56	5.42	53.0
.....	....	....	20.00	9.00	.....	5.00	....
22033	8.27	5.66	10.94	10.88	59.29	4.96	41.0
.....	....	....	9.00	.....	.....	4.00	....
22167	7.33	4.08	23.13	5.82	54.23	5.41	50.0
.....	....	....	18.00	9.50	.....	4.50	....
22166	7.20	3.63	9.88	9.31	63.46	6.52	44.0
.....	....	....	9.00	12.00	.....	5.00	....
22138	9.39	6.00	24.13	6.03	49.65	4.80	96.0
.....	....	....	24.00	.....	.....	5.00	....
22179	7.79	4.54	10.00	10.26	62.84	4.57	47.0
.....	....	....	9.00	.....	.....	3.00	....
22146	8.28	4.87	24.00	7.84	50.15	4.86	55.0
.....	....	....	24.00	10.00	.....	5.00	....
22147	7.78	3.90	10.94	11.24	63.57	2.57	41.0
.....	....	....	10.00	12.75	.....	4.00	....
22164	8.59	3.87	26.13	6.08	49.88	5.45	49.0
.....	....	....	20.00	9.00	.....	4.00	....
22168	7.88	4.03	11.75	10.65	62.31	3.38	42.0
.....	....	....	10.00	14.00	.....	5.00	....
22128	7.45	5.09	21.63	11.17	49.90	4.76	50.0
.....	....	....	22.00	14.00	.....	4.00	....
22015	6.26	3.63	9.50	10.35	63.66	6.60	46.0
.....	....	....	9.00	9.50	.....	4.00	....
22068	8.17	4.88	26.63	7.84	46.62	5.86	54.0
.....	....	....	25.00	.....	.....	5.50	....
22069	7.51	6.03	21.00	7.64	51.72	6.10	54.0
.....	....	....	20.00	.....	.....	5.00	....
22088	8.57	6.01	25.25	7.20	47.04	5.93	55.0
.....	....	....	24.00	.....	.....	5.00	....
22098	8.10	4.50	25.19	7.62	48.80	5.79	57.0
.....	....	....	25.00	10.00	.....	5.00	....
22101	8.65	3.30	10.25	9.79	63.74	4.27	46.0
.....	....	....	9.00	.....	.....	3.50	....
22027	5.81	3.99	8.31	13.52	63.97	4.40	....
.....	....	....	7.00	.....	.....	3.00	....
22074	9.54	5.57	20.19	7.26	52.69	4.75	49.0
.....	....	....	20.00	9.00	.....	5.00	....
22185	7.61	5.40	8.63	14.62	61.53	2.21	39.0
.....	....	....	10.50	.....	.....	4.00	....
22094	9.01	4.84	23.38	8.11	49.60	5.06	56.0
.....	....	....	23.00	.....	.....	4.00	....
22079	9.28	5.30	25.88	6.65	48.78	4.11	56.0
.....	....	....	24.00	9.00	.....	5.00	....
22096	9.26	4.59	17.00	6.40	58.20	4.55	....
.....	....	....	12.00	8.00	.....	3.50	....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	PROPRIETARY MIXED FEEDS—*Continued.*	
	Horse, Dairy and Stock Feeds—Continued.	
22097	Fulpail Dairy Ration. Eastern States Farmers' Exchange, Springfield, Mass..	*Farmington:* C. E. Stephenson Guaranty..................
22192	Fulpail Dairy Ration. Eastern States Farmers' Exchange, Springfield, Mass..	*Middletown:* Arthur Congdon. Guaranty..................
22193	Fulpail Dairy Ration. Eastern States Farmers' Exchange, Springfield, Mass..	*Newtown:* Benjamin Bernstein Guaranty..................
22155	Elmore Horse Feed. Elmore Milling Co., Oneonta, N. Y....................	*Somers:* W. C. Everitt........ Guaranty..................
22121	Elmore Milk Grains. Elmore Milling Co., Oneonta, N. Y....................	*Thompsonville:* Geo. S. Phelps Guaranty..................
22070	Eshelman's 16% Dairy Feed. John W. Eshelman & Sons, Lancaster, Pa......	*Danbury:* F. C. Benjamin..... Guaranty..................
22003	Eshelman's 20% Dairy Feed. John W. Eshelman & Sons, Lancaster, Pa......	*Seymour:* Seymour Grain & Co Guaranty..................
22104	Eshelman's 8.5% Horse Feed. John W. Eshelman & Sons, Lancaster, Pa......	*Wallingford:* A. E. Hall...... Guaranty..................
22112	Grandin's 24% Balanced Dairy Ration. D. H. Grandin Milling Co., Jamestown, N. Y.	*Willimantic:* Willimantic Grain Guaranty..................
22171	Grandin's Stock Feed. D. H. Grandin Milling Co., Jamestown, N. Y.........	*Norwich:* Norwich Grain Co... Guaranty..................
22182	Twin Six Dairy Feed. D. H. Grandin Milling Co., Jamestown, N. Y.........	*Willimantic:* Willimantic Grain Guaranty..................
22018	Century Horse Feed. Dwight Hamlin, Inc., Pittsburgh, Pa.....................	*Southport:* C. Buckingham & C Guaranty..................
22023	Algrane Milk Feed. H-O Cereal Co., Inc., Buffalo, N. Y......................	*South Norwalk:* Roodner Feed Guaranty..................
22165	New England Stock Feed. H-O Cereal Co., Buffalo, N. Y..................	*Mystic:* J. L. Manning & Co... Guaranty..................
22091	Imperial Steam Cooked Feed. Imperial Grain and Mill Co., Toledo, Ohio.....	*Bristol:* Goodsell Bros......... Guaranty..................
22024	Kramco Dairy Ration. Chas. A. Krause Milling Co., Milwaukee, Wis..........	*South Norwalk:* Roodner Feed Guaranty..................
22064	Larro Ready Ration. Larrowe Milling Co., Detroit, Mich..................	*New Milford:* Geo. E. Ackley & Guaranty..................
22052	Bull Dairy Ration. Maritime Milling Co. Buffalo, N. Y......................	*Canaan:* Ives & Pierce........ Guaranty..................
22058	Red Star Dairy Feed. E. Manchester & Sons, Winsted, Conn.................	*Winsted:* E. Manchester & Sons Guaranty..................
22136	Barford's Balanced Dairy Ration. Meech & Stoddard, Inc., Middletown, Conn...	*Middletown:* Meech & Stoddard Guaranty..................
22108	Red Wing Dairy Ration. Meech & Stoddard, Inc., Middletown, Conn.........	*Meriden:* Meriden Grain & Coa Guaranty..................
22131	Red Wing Junior Dairy Ration. Meech & Stoddard, Inc., Middletown, Conn.....	*Middlefield:* Middlefield Gr. & (Guaranty..................
22183	Red Wing Junior Dairy Ration. Meech & Stoddard, Inc., Middletown, Conn.....	*Hartford:* Meech Grain Co.... Guaranty..................

Inspection of 1923—*Continued.*

ion o.	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	Price per ton
	Pounds per Hundred						
97	8.78	4.84	22.81	8.07	51.14	4.36	$48.94
..	....	....	20.00	9.00	.....	4.50	.....
192	5.12	9.28	22.13	6.47	52.81	4.19	48.94
..	....	....	20.00	9.00	.....	4.00	.....
193	9.16	5.63	22.63	7.43	50.10	5.05	48.00
..	....	....	20.00	9.00	.....	4.50	.....
155	8.34	3.80	19.00	11.90	63.88	3.08	43.00
...	....	....	9.00	14.00	.....	3.00	.....
121	8.73	6.03	24.44	7.94	47.71	5.15	55.00
...	....	....	25.00	11.00	.....	6.00	.....
70	7.16	6.46	21.19	11.81	47.78	5.60	45.00
...	....	....	16.00	.....	.....	3.00	.....
03	8.77	6.94	19.63	10.04	49.76	4.86	48.00
...	....	....	20.00	.....	.....	4.00	.....
104	5.86	3.76	12.19	7.81	66.09	4.29	50.00
...	....	....	9.00	.....	.....	3.00	.....
112	9.23	5.05	24.00	7.42	48.44	5.86	55.00
...	....	....	24.00	.....	.....	5.00	.....
171	7.50	3.42	9.50	8.78	65.55	5.25	46.00
...	....	....	9.00	.....	.....	5.00	.....
182	7.69	5.22	22.25	8.03	51.36	5.45	53.00
...	....	....	22.00	.....	.....	5.00	.....
18	4.45	8.14	8.25	9.67	7.47	2.02	37.00
...	....	....	6.00	10.00	.....	2.00	.....
23	6.91	5.39	17.50	11.33	55.50	3.37	49.00
...	....	....	16.00	15.00	.....	4.00	.....
165	8.54	5.05	12.81	6.86	61.97	4.77	44.00
...	....	....	9.50	.....	.....	4.00	.....
91	8.41	2.17	11.25	4.01	69.46	4.70	57.00
...	....	....	9.00	.....	.....	4.00	.....
24	6.73	5.35	21.63	9.55	51.55	5.19	54.00
...	....	....	20.00	.....	.....	4.00	.....
64	8.49	5.40	20.63	10.52	50.71	4.25	56.00
...	....	....	20.00	.....	.....	4.00	.....
52	7.37	7.39	25.13	9.79	44.36	5.96	54.00
...	....	....	24.00	.....	.....	5.00	.....
58	7.82	4.96	20.13	6.96	53.80	6.33	52.00
...	....	....	23.00	10.00	.....	4.00	.....
136	7.41	4.41	20.13	7.15	54.19	6.71	51.00
...	....	....	19.00	.....	.....	5.50	.....
108	7.64	4.07	20.13	7.05	55.13	5.98	57.00
...	....	....	24.00	9.00	.....	6.00	.....
131	7.54	5.47	17.88	6.93	56.91	5.27	51.00
...	....	....	20.00	.....	.....	6.00	.....
183	7.19	5.42	18.19	7.66	56.16	5.38	52.00
...	..	....	20.00	.....	.....	6.00	.....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	PROPRIETARY MIXED FEEDS—*Continued.* *Horse, Dairy and Stock Feeds—Continued.*	
22134	Red Wing Stock Feed. Meech & Stoddard, Inc., Middletown, Conn.	*Middlefield:* Middlefield Gr. & (Guaranty
21996	Victory Horse Feed. Metropolitan Mills, Hoboken, N. J.	*Derby:* Peterson-Hendee Co. Guaranty
22122	Mystic Stock Feed. Mystic Milling Co., Rochester, N. Y.	*Thompsonville:* Geo. S. Phelps & Guaranty
22037	Uncle John's 24% Cream Pot Ration. Ontanio Milling Co., Oswego, N. Y.	*Waterbury:* H. S. Coe & Co. Guaranty
22174	Bison Stock Feed. Park & Pollard Co., Boston, Mass.	*Colchester:* P. Cutler Guaranty
22012	Stevens Mil Kade Calf Meal. Park & Pollard, Boston, Mass.	*Waterbury:* Spencer Grain Co. Guaranty
22050	Pillsbury's Dairy Ration. Pillsbury Mills, Minneapolis, Minn.	*Canaan:* Ives & Pierce Guaranty
22116	Pillsbury's Dairy Ration. Pillsbury Mills, Minneapolis, Minn.	*Granby:* E. H. Rollins Guaranty
22031	Purina Cow Chow Feed. Purina Mills, St. Louis, Mo.	*Stamford:* Francis H. Leggett & Guaranty
22076	Protena Dairy Feed. Purina Mills, St. Louis, Mo.	*Norwalk:* Francis H. Leggett & Guaranty
22159	Purina Pig Chow. Purina Mills, St. Louis Mo.	*Rockville:* Rockville Grain & Co Guaranty
22075	Iowa Stock Feed. Purity Oats Co., Chicago, Ill.	*Norwalk:* Francis H. Leggett & Guaranty
22085	Big Q Dairy Ration. Quaker Oats Co., Chicago, Ill.	*Hamden:* I. W. Beers Guaranty
22040	Schumacher's Sugared Feed. Quaker Oats Co., Chicago, Ill.	*Waterbury:* H. S. Coe & Co. Guaranty
22188	Schumacher's Feed. Quaker Oats Co., Chicago, Ill.	*New Haven:* R. G. Davis & So Guaranty
22077	White Star Fine Feed. Quaker Oats Co., Chicago, Ill.	*Norwalk:* Francis H. Leggett & Guaranty
22161	Rosebro Horse Feed. Rosenbaum Bros., Chicago, Ill.	*Chester:* Leet Bros. Guaranty
22115	Ryde's Cream Calf Meal. Ryde & Company, Chicago, Ill.	*Willimantic:* Willimantic Grain Guaranty
22144	Honest Hog Feed. Winchell Smith, Farmington, Conn.	*Farmington:* Winchell Smith Guaranty
22145	Mill Stream Boomerang Dairy Feed. Winchell Smith, Farmington, Conn.	*Farmington:* Winchell Smith Guaranty
22046	Syragold Dairy Feed. Syracuse Milling Co., Syracuse, N. Y.	*Norfolk:* Aug. P. Curtis Guaranty
22095	Syragold Stock Feed. Syracuse Milling Co., Syracuse, N. Y.	*Plainville:* Eaton Bros. Guaranty
22016	Red Brand Ti-O-Ga Dairy Feed. Tioga Mill & Elevator Co., Waverly, N. Y.	*West Cheshire:* G. W. Thorpe Guaranty
22082	White Brand Dairy Feed. Tioga Mill & Elevator Co., Waverly, N. Y.	*New Canaan:* C. H. Fairty Co. Guaranty

INSPECTION OF 1923—*Continued.*

ation No.	Pounds per Hundred						Price per ton
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, (etc.)	Ether Extract (Crude fat)	
2134	7.34	5.00	9.69	9.47	63.30	5.20	$46.00
...	....	....	9.00	7.00	.....	3.00	.....
1996	7.74	6.55	8.50	11.17	64.56	1.48	48.00
...	....	....	8.00	15.00	.....	1.00	.....
2122	8.67	4.27	14.19	7.50	60.85	4.52	43.00
...	....	....	9.00	....	.....	3.00	.....
2037	8.49	5.41	23.50	7.96	48.58	6.06	55.00
...	....	....	24.00	.....	.....	5.50	.....
2174	7.43	6.50	8.25	13.45	61.91	2.46	44.00
...	....	....	8.00	.....	.....	2.00	.....
2012	7.92	7.12	20.38	5.40	52.33	6.85	89.00
...	....	....	20.00	.....	.....	3.00	.....
2050	7.99	7.05	20.44	8.78	50.33	5.41	51.00
...	....	....	20.00	11.00	.....	4.00	.....
2116	8.37	7.61	20.13	7.82	50.70	5.37	47.00
...	....	....	20.00	.....	.....	4.00	.....
2031	8.66	6.60	24.31	11.44	43.78	5.21	63.00
...	....	....	24.00	.....	.....	4.30	.....
2076	8.55	6.55	17.38	11.66	51.58	4.28	45.00
...	....	....	16.50	.....	.....	3.50	.....
2159	7.81	6.72	20.50	6.94	53.05	4.98	69.00
...	....	....	20.00	.....	.....	3.20	.....
2075	7.54	3.90	9.88	10.50	63.27	4.91	43.00
...	....	....	10.00	12.00	.....	5.50	.....
2085	8.25	5.44	23.00	9.94	48.53	4.84	54.00
...	....	....	21.00	.....	.....	4.00	.....
2040	7.72	4.79	10.63	10.34	61.95	4.57	45.00
...	....	....	10.00	.....	.....	3.25	.....
2188	7.51	4.10	10.00	11.15	63.41	3.83	44.00
...	....	....	10.00	.....	.....	3.25	.....
2077	8.09	4.41	7.88	12.53	63.88	3.21	40.00
...	....	....	8.00	.....	.....	3.00	.....
2161	7.35	3.10	10.94	6.85	67.23	4.53	48.00
...	....	....	10.00	.....	.....	2.00	.....
2115	8.84	6.20	25.00	4.91	50.90	4.15	95.00
...	....	....	25.00	.....	.....	5.00	.....
2144	8.78	6.13	16.88	3.54	59.86	4.81	45.00
...	....	....	.....	.....	.....	....	.....
2145	7.79	4.86	17.38	9.19	56.01	4.77	52.00
...	....	....	23.00	.....	.....	6.00	.....
2046	8.01	4.87	24.88	8.86	48.00	5.38	54.00
...	....	....	24.00	.....	.....	4.50	.....
2095	2.95	5.07	10.44	10.61	66.52	4.41	43.00
...	....	....	9.00	12.00	.....	3.00	.....
2016	7.11	6.61	25.00	9.14	46.63	5.51	53.00
...	....	....	24.00	10.00	.....	4.50	.....
2082	9.14	6.44	21.75	5.84	51.27	5.56	55.00
...	....	....	20.00	10.00	.....	4.50	.....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	PROPRIETARY MIXED FEEDS—*Continued.*	
	Horse, Dairy and Stock Feeds—Concluded.	
22087	Biles Ready Dairy Ration. Ubiko Milling Co., Cincinnati, Ohio	*Plantsville:* C. A. Cowles Guaranty
22173	Red Tag Big Y Stock Feed. The Yantic Grain & Products Co., Norwich, Conn.	*Norwich:* Yantic Grain & Products Guaranty
	Poultry Feeds.	
22063	Cak-Cak Laying Mash. Armour Grain Co., Chicago, Ill	*New Milford:* Geo. E. Ackley & (Guaranty
22034	Iroquois Poultry Mash. Armour Grain Co., Chicago, Ill	*Stamford:* W. L. Crabb Guaranty
22036	Basic Laying Mash No. 93. Basic Feeds Co., Lockport, Ill	*Stamford:* W. L. Crabb Guaranty
22180	Parex Dry Mash. Bosworth Bros., Putnam, Conn	*Putnam:* Bosworth Bros Guaranty
22142	Servus Egg Mash, With Milk. Thomas-Boyce, Attica, N. Y.	*Farmington:* Winchell Smith Guaranty
22169	Egg Dry Mash. C. W. Campbell Co., Westerly, R. I.	*Westerly:* C. W. Campbell Co Guaranty
22143	Peerless Laying Mash. Clover Leaf Milling Co., Buffalo, N. Y.	*Farmington:* Winchell Smith Guaranty
22080	Conkey's Starting Feed. C. E. Conkey Co. Cleveland, Ohio	*New Canaan:* C. H. Fairty Co Guaranty
22086	Laying Mash. C. A. Cowles, Plantsville, Conn	*Plantsville:* C. A. Cowles Guaranty
22065	Wirthmore Buttermilk Mash Feed. Chas. M. Cox Co., Boston, Mass	*New Milford:* Geo. T. Soule Guaranty
22189	Poultry Mash. Crittenden-Benham Co., New Haven, Conn	*New Haven:* Crittenden-Benham Guaranty
22156	Elmore Egg Mash. Elmore Milling Co., Oneonta, N. Y.	*Somers:* W. C. Everett Guaranty
22025	Eshelman's Laying Mash. John W. Eshelman & Sons, Lancaster, Pa	*South Norwalk:* Roodner Feed Co Guaranty
22151	Golden Egg Laying Mash. Flory Milling Co., Bangor, Pa	*Bloomfield:* Bloomfield Farmers' I Guaranty
22150	Flory's Superior Egg Mash. Flory Milling Co., Bangor, Pa	*Bloomfield:* Bloomfield Farmers' I Guaranty
22113	Grandin's Poultry Dry Mash with Buttermilk. D. H. Grandin Mill. Co., Jamestown, N. Y.	*Willimantic:* Willimantic Grain C Guaranty
22020	Algrane Laying Mash. H-O Cereal Co., Inc., Buffalo, N. Y.	*South Norwalk:* Roodner Feed Co Guaranty
22057	Storrs Egg Mash. E. Manchester & Sons, Winsted, Conn	*Winsted:* E. Manchester & Sons Guaranty
22035	Bull Laying Mash. Maritime Milling Co., Buffalo, N. Y.	*Stamford:* W. L. Crabb Guaranty
22105	Red Wing Dry Mash. Meech & Stoddard, Inc., Middletown, Conn	*Meriden:* Meriden Grain & Coal C Guaranty

INSPECTION OF 1923—*Continued.*

ion o.	Pounds per Hundred						Price per ton
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
)87	8.06	5.76	23.75	7.57	49.30	5.56	$55.00
..	....	....	24.00	10.00	.....	5.00	.....
173	7.72	3.72	9.94	8.73	63.27	6.62	45.00
..	....	....	9.00	12.00	.....	4.00	.....
)63	8.36	6.60	20.00	3.26	57.13	4.65	68.00
..	....	....	20.00	.....	.....	3.00	.....
)34	8.86	4.65	15.81	6.06	58.97	5.65	55.00
..	....	....	15.00	.....	.....	4.00	.....
)36	9.32	7.15	22.13	4.44	51.76	5.20	65.00
..	....	....	20.00	5.00	.....	5.00	.....
180	8.64	5.78	18.94	6.23	55.52	4.89	67.00
..	....	....	18.00	.....	.....	4.00	.....
142	8.17	6.27	19.44	5.47	55.15	5.50	69.00
..	....	....	18.00	8.00	.....	4.00	.....
169	7.33	9.35	20.94	6.89	49.10	6.39	61.00
..	....	....	18.00	.....	.....	2.00	.....
143	8.13	6.03	18.44	6.69	55.55	5.16	59.00
...	....	....	18.00	10.00	.....	4.00	.....
)80	9.42	4.26	12.00	2.52	67.07	4.73	74.00
..	....	....	12.00	.....	.....	3.00	.....
)86	9.13	7.79	20.13	4.47	52.27	6.21	59.00
..	....	....	20.00	4.50	.....	4.00	.....
)65	8.24	9.13	21.38	5.17	51.02	5.06	65.00
..	....	....	20.00	.....	.....	4.00	.....
189	7.38	10.64	21.88	6.05	47.35	6.70	56.00
..	....	....	18.00	.....	.....	4.00	.....
156	7.59	6.93	21.75	5.44	53.01	5.28	62.00
..	....	....	18.00	.....	.....	4.00	.....
)25	6.48	8.68	23.75	4.78	49.59	6.72	61.00
..	....	....	20.00	.....	.....	5.00	.....
151	6.79	7.26	20.81	10.21	49.00	5.93	55.00
..	....	....	18.00	10.00	.....	4.00	.....
150	7.46	8.97	20.50	7.59	49.76	5.72	62.00
..	....	....	20.00	8.00	.....	5.50	.....
113	8.78	9.25	21.38	5.20	50.48	4.91	59.00
..	....	....	20.00	.....	.....	3.00	.....
)20	6.79	9.57	17.13	3.71	57.19	5.61	64.00
..	....	....	17.00	6.00	.....	4.50	.....
)57	7.36	10.01	21.88	5.83	47.64	7.28	56.00
..	....	....	18.00	.....	.....	4.00	.....
)35	9.70	8.43	21.38	5.21	49.86	5.42	65.00
..	....	....	20.00	.....	.....	5.00	.....
.05	8.24	8.03	17.00	5.40	55.15	6.18	63.00
..	....	....	17.00	.....	.....	5.50	.....

TABLE III. ANALYSES OF COMMERCIAL FEEDS,

Station No.	Manufacturer and Brand	Retail Dealer
	PROPRIETARY MIXED FEEDS—*Concluded.* *Poultry Feed—Concluded.*	
22106	Red Wing Growing Feed. Meech & Stoddard, Inc., Middletown, Conn.	*Meriden:* Meriden Grain & Coa Guaranty
22152	Marathorn Laying Mash. Nowak Milling Co., Hammond, Ind	*Bloomfield:* Bloomfield Farmers Guaranty
22090	Lay or Bust Dry Mash. Park & Pollard, Boston, Mass	*Plantsville:* C. A. Cowles Guaranty
21992	Platco Laying Mash Mixture. Frank S. Platt Co., New Haven, Conn	*New Haven:* Frank S. Platt Co Guaranty
22071	Purina Chicken Chowder. Purina Mills, St. Louis, Mo	*Danbury:* H. E. Meeker Guaranty
22178	Ful-O-Pep Dry Mash. Quaker Oats Co., Chicago, Ill	*Putnam:* F. M. Cole Guaranty
22140	Quisenberry "Big 4" Laying Mash. Quisenberry Feed Mfg. Co., Buffalo, N. Y.	*Farmington:* Winchell Smith Guaranty
22141	Quisenberry Quality Buttermilk Laying Mash. Quisenberry Feed Mfg. Co., Buffalo, N. Y.	*Farmington:* Winchell Smith Guaranty
22029	Vitality Egg Mash. Rosenbaum Bros., Chicago, Ill	*Stamford:* Francis H. Leggett & Guaranty
22184	Chic-Chuk Poultry Food. Russia Cement Co., Gloucester, Mass	*Hartford:* Meech Grain Co Guaranty
22006	Home Made Milk Mash. Seymour Grain & Coal Co., Seymour, Conn	*Seymour:* Seymour Grain & Coa Guaranty
22139	Mill Streams Lightnin Laying Mash. Winchell Smith, Farmington, Conn	*Farmington:* Winchell Smith Guaranty
22081	Egatine. Tioga Mill & Elevator Co., Waverly, N. Y.	*New Canaan:* C. H. Fairty Co. Guaranty

INSPECTION OF 1923—*Concluded.*

tation No.	Pounds per Hundred						Price per ton
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
2106	7.87	14.86	17.88	4.61	48.79	5.99	$63.00
....	....	....	10.00	.....	.....	6.00	.....
2152	7.78	6.82	20.75	5.92	53.61	5.12	56.00
...	....	....	20.00	.....	.....	4.50	.....
090	8.50	9.14	19.38	6.16	51.71	5.11	60.00
...	.....	....	18.00	.....	.....	1.50	.....
992	9.93	8.80	18.88	5.70	49.74	6.95	67.00
...	....	....	18.94	.....	.....	5.38	.....
071	8.38	6.89	19.75	7.25	52.56	5.17	75.00
...	....	....	19.00	.....	.....	4.00	.....
178	7.56	9.46	20.88	6.88	49.49	5.73	76.00
...	....	....	20.00	.....	.....	4.00	.....
140	8.01	6.27	17.88	7.65	55.10	5.09	67.00
...	....	....	17.00	6.00	.....	4.00	.....
141	7.85	6.84	20.63	5.28	54.11	5.29	71.00
...	....	....	18.00	5.00	.....	4.00	.....
029	9.09	7.56	21.13	4.68	52.29	5.25	82.00
..	....	....	20.00	7.00	....	4.00	.....
.84	3.21	30.15	63.31	.....	1.06	2.27	90.00
..	....	....	45.00	.....	.....	2.00	.....
06	9.89	8.28	18.75	5.22	53.22	4.64	69.00
..	....	....	.....	.....	.....	....	.....
39	8.22	8.99	20.88	5.51	51.10	5.30	61.00
..	....	....	16.00	.....	.....	3.00	.....
81	8.58	8.36	26.63	3.35	47.18	5.90	64.00
..	....	....	23.00	.....	.....	2.50	.....

TABLE IV. ANALYSES OF FEEDING STUFFS

Station No.	Material	Submitted by
	OIL SEED PRODUCTS.	
	Cottonseed Meal:	
22206	....	*Canterbury:* Park B. Smith.......
20802	Danish..............................	*Middletown:* The Coles Company.
21780	Cameron-Daniell Co..................	The Coles Company..........
21745	Thirty-six..........................	The Coles Company..........
	CORN PRODUCTS.	
22342	Hominy..............................	*Bloomfield:* Bloomfield Farmers' E
	PROPRIETARY MIXED FEEDS.	
	Horse, Dairy and Stock Feeds.	
22405	Eastern States Dairy Ration...........	*Hartford:* Francis P. Nolan......
22406	Cornell Ration.......................	Francis P. Nolan.............
19711	Dairy Feed..........................	*Meriden:* Raymond Ives.........
22446	Dairy Ration 24%....................	*Middletown:* The Coles Company.
22679	Dairy Ration 24%....................	The Coles Company..........
22560	Dairy Ration 24%....................	The Coles Company..........
20894	Uncle John 24% Cream Pot Ration......	The Coles Company..........
21259	Uncle John 24% Cream Pot Ration......	The Coles Company..........
21797	Uncle John 24% Cream Pot Ration.....	The Coles Company..........
21260	Uncle John 18% Dairy Ration..........	The Coles Company..........
21796	Uncle John 18% Dairy Ration..........	The Coles Company..........
21825	Uncle John 18% Dairy Ration..........	The Coles Company..........
21982	Special Dairy Feed....................	The Coles Company..........
22594	Eastern States Milkmore Dairy Ration...	*Rockville:* H. B. Pomeroy........
21106	Algrane Milk Feed....................	*South Norwalk:* Roodner Feed Co
20826	Feed No. 1..........................	*Yantic:* John H. Ryan..........
20827	Feed No. 2..........................	John H. Ryan..............
	Poultry Feeds.	
22626	Eastern States-Egg Mash, No. 1........	*Central Village:* Birchwood Farm
22627	Eastern States Egg Mash, No. 2........	Birchwood Farm, Inc.........
21879	Chicken Feed........................	*Centerville:* S. Thomson.........
21859	Fortune Egg Mash....................	*Middletown:* The Coles Company.
22593	Eastern States Egg Mash..............	*Norwich:* F. W. Browning.......
21315	Feed................................	The Yantic Grain & Products C
22538	Eastern States Egg Mash..............	The Yantic Grain & Products C
20750	Ground Navy Soup Beans..............	*Pittsburgh, Pa.:* Dwight Hamlin, .
	MISCELLANEOUS.	
21841	Wheat Bran.........................	*New Haven:* Station Agent, stocl R. G. Davis............
21842	Cottonseed Meal.....................	Station Agent...............
21843	Corn Meal..........................	Station Agent...............
21844	Dairy Ration........................	Station Agent...............

SUBMITTED BY INDIVIDUALS.

Pounds per Hundred						
Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	Remarks
....	....	36.13	....	....	....	
....	....	37.44	....	....	....	
....	....	35.69	....	....	....	
....	....	34.75	....	....	....	
9.54	2.34	10.00	3.78	68.08	6.26	
5.84	5.12	22.63	6.38	54.70	5.33	
5.31	9.28	19.69	6.31	53.60	5.81	
12.57	5.85	19.69	6.17	51.41	4.31	
8.11	5.27	22.75	6.44	51.75	5.68	
5.53	....	23.50	....	....	6.59	Guaranty; protein 24 per cent.
....	....	23.31	....	....	....	
....	....	24.81	....	....	....	Guaranty; protein 24 per cent.
....	....	24.00	....	....	....	Guaranty; protein 24.90 per cent.
....	....	24.56	....	....	....	Guaranty; protein 24 per cent.
....	....	17.50	....	....	....	Guaranty; protein 18.90 per cent.
....	....	16.75	....	....	....	Guaranty; protein 18 per cent.
....	....	16.75	....	....	....	Guaranty; protein 18 per cent.
9.22	5.84	20.88	7.50	50.02	6.54	
....	....	25.00	....	....	....	Guaranty; protein 24 per cent.
....	....	17.50	....	....	....	Guaranty; protein 16 per cent.
....	....	11.88	....	....	....	
....	....	6.13	....	....	....	
....	....	23.63	....	....	....	Guaranty; protein 20 per cent.
....	....	25.38	....	....	....	Guaranty; protein 20 per cent.
10.59	7.76	21.50	4.43	50.72	5.00	
9.03	11.02	18.25	5.46	51.20	5.04	
....	....	23.50	....	....	....	Guaranty; protein 22 per cent.
....	....	22.63	....	....	....	
10.20	5.10	22.75	5.79	51.75	4.41	
7.19	5.73	24.00	4.89	56.53	1.66	
11.46	5.57	15.38	9.96	51.58	6.05	Feeding Experiments, Storrs.
8.91	5.27	34.50	15.37	29.77	6.18	Feeding Experiments, Storrs.
13.36	1.07	9.75	2.60	70.21	3.08	Feeding Experiments, Storrs.
11.51	3.75	17.81	8.52	53.53	4.88	Feeding-Experiments, Storrs.

TABLE IV. ANALYSES OF FEEDING STUFFS,

Station No.	Material	Submitted by
	MISCELLANEOUS—*Concluded.*	
21835	Eastern States Milkmore Ration........	*Meriden:* Station Agent, stoc Minor Ives................
21836	Eastern States Egg Mash..............	Station Agent, stock of Mino
22234	Eastern States Milkmore Ration........	*Farmington:* Station Agent, sto C. E. Stephenson........
22235	Eastern States Milkmore Ration........	Station Agent, stock of C. E. S enson..................
22236	Eastern States Milkmore Ration........	Station Agent, stock of C. E. S enson..................
20514	Mill Sweepings........................	Wadsworth & Wadsworth...
22612	Spratt's Dog Biscuit..................	*Hartford:* Dairy & Food Comm'i
22613	Austin's Dog Biscuit..................	Dairy & Food Commissioner.

MISCELLANEOUS SAMPLES.

SAMPLES SUBMITTED BY INDIVIDUALS OR DRAWN AT THEIR REQUEST.

Table IV summarizes analyses made for individuals. In most cases samples were drawn by the senders; but in a few cases samples were officially drawn by our agent on request.

These samples come under the head of gratuitous analyses which have been discussed elsewhere in this report.

MATERIALS EXAMINED FOR POISONS.[1]

19794. *Stock Feed.* Submitted by a purchaser. With the aid of a lense green particles were plainly seen in this sample. Qualitative tests showed copper and arsenic (the essential constituents of Paris Green), in considerable amounts.

21570. *Poultry Mash.* Submitted by a dealer. Thirty chickens died after eating this mash. The feed was composed chiefly of corn meal, bran, oats, etc. Green particles were seen in the feed and there were lumps in which the green substance was present. Chemical tests showed the presence of considerable quantities of copper and arsenic. Paris Green had become mixed with the feed accidentally or otherwise.

18658, 20858, 21915, 22219, 22287, and **22288.** These feeds were examined but nothing was found to explain the unfavorable or fatal results reported to have followed the feeding of these products.

CONDIMENTAL FOODS.[1]

SUBMITTED BY INDIVIDUALS—*Concluded.*

ion o.	Pounds per Hundred						Remarks
	Water	Ash	Protein (N x 6.25)	Fiber	Nitrogen-free Extract (Starch, gum, etc.)	Ether Extract (Crude fat)	
35	9.51	6.42	24.81	8.78	45.53	4.95	Guaranty; protein 24.00, fat 5.00 fiber 9.00 per cent.
36	10.84	4.75	23.88	5.44	50.25	4.84	Guaranty, protein 22.00, fat 3.5 fiber 7.00 per cent.
34	10.53	4.65	25.50	7.10	47.26	4.96	Guaranty; protein 24.00, fat 5.0 per cent.
35	9.04	6.93	25.19	8.75	45.36	4.73	Guaranty; protein 24.00 per cent
36	8.02	7.06	26.75	8.57	44.17	5.43	Guaranty; protein 24.00; fat 5.0 per cent.
14	6.41	6.85	28.63	15.81	36.58	5.72	
12	6.20	3.59	19.88	0.49	66.18	3.66	
13	7.52	1.99	13.00	0.30	75.02	2.17	

user of this product against loss of his stock by contagious disease provided he has fed the conditioner continuously and in accord with directions.

Examination of a sample of this product submitted by a prospective agent was made with the following results:

Moisture 9.88 per cent.; nitrogen 1.12 per cent.; ash (mineral matter), 9.58 per cent.; vegetable bitters, none detected; emodin-like substances, none found; saltpeter, none found; fenugreek bicarbonate of soda, ferrous sulphate and magnesium sulphate, present; seed coats or hulls, large amount present.

Seed coats (resembling cotton hulls) comprised a large proportion of the product. There was about 10 per cent. of mineral matter consisting chiefly of, or containing, bicarbonate of soda, iron and epsom salt. No vegetable bitters or vegetable cathartics were detected.

The mineral ingredients found in this preparation are not uncommon in so-called stock conditioners and tonics. We have no information as to what the directions for feeding this remedy (as specified in the guaranty), are. However, the observation of a leading authority[1] on feeds and feeding seems pertinent in this connection. This text says: "The stock foods are usually accompanied by directions which advocate liberal feeding and good care for the animals to be fed in order to secure the benefits from the tonic". In other words some benefit is bound to arise from the increased care and attention which the animals will be given.

[1] Henry and Morrison.

BULLETIN 258 JUNE, 1924

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

Report on Commercial Insecticides and Fungicides

I. TEXT OF THE INSECTICIDE LAW OF CONNECTICUT AND REGULATIONS FOR ITS ENFORCEMENT.

II. EXAMINATION OF INSECTICIDES, FUNGICIDES, ETC.

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The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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June, 1924.

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Rules and Regulations for Carrying Out the Provisions of the Insecticide and Fungicide Law.

By authority of Section 5 of the Insecticide and Fungicide Act, Chapter 258, Public Acts of 1923, the following rules and regulations have been adopted for carrying out the provisions of the act.

As further provided in said Section these rules and regulations conform, so far as possible, to those laid down by the Secretary of Agriculture of the United States for the enforcement of the Federal Insecticide Act.

Sections cited under each regulation refer to the section of the State law wherein the term defined, or the clause interpreted, occurs; and the citation following each regulation refers to the Federal regulation which corresponds thereto.

WM. L. SLATE, JR.,
Director of the Conn. Agricultural Experiment Station.

THOMAS HOLT.
Dairy and Food Commissioner.

REGULATION 1. ORIGINAL UNBROKEN PACKAGE.

(Section 5.)

The term "original unbroken package" as used in Section 5 of the act, and in these regulations, is the original package, carton, case, can, box, barrel, bottle or other container put up by the manufacturer or dealer, to which the label is attached or which may be suitable for the attachment of a label, making one complete package of the article of insecticide or fungicide. The original package contemplated includes both the wholesale and the retail package.

REGULATION 2. DEFINITIONS OF INSECT AND FUNGI.

(Section 2.)

Insect. The term "insect" as used in Section 2, or elsewhere in the act, and in these regulations, is held to mean any of the numerous small invertebrate animals generally having the body more or less obviously segmented, for the most part belonging to the class *Insecta*, comprising six-legged, usually winged forms, as beetles, bugs, bees, flies, etc., and to other allied classes of arthropods whose members are wingless and usually have more

than six legs, as spiders, mites, ticks, centipedes, wood lice, etc. (F. R. 14.)

Fungi. The term "fungi", as used in Section 2, or elsewhere in the act, and in these regulations, is held to mean all nonchlorophyll-bearing plants of a lower order than mosses and liverworts (i.e. nonchlorophyll-bearing thallophytes), comprising rusts, smuts, mildews, molds, yeasts, bacteria, etc. (F.R. 14a.)

Regulation 3. Concerning Labels.

(Section 4.)

(a) The term "label" as used in Section 4, or elsewhere in the act, and in these regulations, is held to include any legend, descriptive matter or design printed, stenciled, stamped, seared or impressed upon the article or its container and also to include circulars, pamphlets, etc., which are packed and go with the article to the purchaser. (F.R.10.)

(b) Whenever, by the terms of the act, information is required to be stated upon the label of an insecticide or fungicide, such as the statement of percentage of arsenic contained therein, a label must be placed on the article in order that the statement can be made and the omission of a label does not excuse the absence of the required statement. (F.R.11.)

(c) All information required to be given on the label must be plainly and correctly stated in type sufficiently clear and in position sufficiently prominent to attract the immediate attention of the purchaser. (F.R.12.)

(d) Descriptive matter upon the label must be free from any statement, design or device regarding the article or the ingredients or substances contained therein, or regarding the quality or effects thereof, which is false or misleading in any particular. (F.R.15.)

(e) The use of any false or misleading statement, design or device appearing upon the label shall not be justified by any statement given as the opinion of an expert or other person, nor by any descriptive matter explaining the use of the false or misleading statement, design or device. (F.R.17.)

Regulation 4. Concerning the Name and Address of the Manufacturer.

(Section 5.)

The name of the manufacturer or producer or the place of manufacture is not required to be given upon the label, but if given it must be the true name and true place. If the name appearing upon the label is not that of the actual manufacturer or producer it shall be preceded by the words "Packed for....," "Distributed by......," or some equivalent phrase. In case

no name appears the dealer is held responsible unless he can furnish a guaranty from the wholesaler, jobber or manufacturer as provided in Section 5 of the act.

Regulation 5. Concerning the Collection of Samples.

(Section 7.)

Section 7 of the act provides that duly authorized agents of the Connecticut Agricultural Experiment Station or of the Dairy and Food Commissioner may take duplicate samples of any insecticide or fungicide upon tendering the market price thereof.

Such samples shall be representative of the lot or parcel sampled. In the case of bulk goods the sample shall be divided in two parts each sealed, dated and marked for identification. In case of goods in package form if each package be 2 pounds or less in weight or 1 quart or less in volume, two packages may be taken each sealed, dated and marked for identification. If packages are more than 2 pounds in weight or more than 1 quart in volume, a sample may be taken in whatever way is most practicable, divided into two parts, each sealed, dated and marked for identification. In all cases one of the duplicate samples shall be delivered by the sampling agent to the Connecticut Agricultural Experiment Station for analysis and the other left with the person whose stock is sampled.

Regulation 6. Concerning Methods of Analysis.

(Section 7.)

The methods of analysis employed shall be those prescribed by the Association of Official Agricultural Chemists or other approved methods.

An Act Concerning the Manufacture, Sale and Transportation of Adulterated or Misbranded Insecticides and Fungicides.

(Chapter 258, Public Acts of 1923.)

Section 1. No person shall manufacture, sell, offer or expose for sale any Paris green, lead arsenate or other insecticide or any fungicide which is adulterated or misbranded within the meaning of this act.

Sec. 2. The Term "insecticide" shall include any substance or mixture of substances intended to destroy or repel insects. The term "Paris green" shall include the product commercially known as Paris green and chemically known as aceto-arsenite of copper. The term "lead arsenate" shall include the products commercially known as lead arsenate consisting chemically of products derived from arsenic acid (H_3AsO_4) by replacing one or more hydrogen atoms by lead. The term "fungicide" shall include any substance or mixture of substances intended to lessen the growth of or destroy fungi.

Sec. 3. Paris green shall be deemed adulterated: (a) when it shall not contain at least fifty per centum of arsenious oxide (As_2O_3); (b) when it shall contain arsenic in water-soluble forms equivalent to more than

three and one-half per centum arsenious oxide (As_2O_3); or (c) when any substance shall have been mixed and packed with it so as to reduce, lower or injuriously affect its quality or strength. Lead arsenate, not dry or powdered, shall be deemed adulterated: (a) When it shall contain more than fifty per centum of water; (b) when it shall contain total arsenic equivalent to less than twelve and one-half per centum arsenic oxide (As_2O_5); (c) when it shall contain arsenic in water-soluble forms equivalent to more than seventy-five one-hundredths per centum arsenic oxide (As_2O_5); or (d) when any substance shall have been mixed and packed with it so as to reduce, lower or injuriously affect its quality or strength; provided lead arsenate and water shall not be deemed to be adulterated when such mixture shall contain more than fifty per centum of water if such mixture shall be labeled lead arsenate and water and the percentage of water shall be plainly and correctly stated on the label. Dry or powdered lead arsenate shall be deemed adulterated when it shall contain total arsenic equivalent to less than twenty-five per centum of arsenic oxide (As_2O_5) and arsenic in water-soluable forms equivalent to more than one and one-half per centum of arsenic oxide (As_2O_5). Insecticides and fungicides other than Paris green and lead arsenate shall be deemed adulterated: (a) When the strength or purity shall fall below the standard or quality under which it shall be sold; (b) when any substance shall have been substituted wholly or in part for the article described; (c) when any valuable constituent of the article shall have been wholly or in part abstracted; or (d) when it shall be intended for use on vegetation and shall contain any substance which, although destroying or repelling insects or lessening the growth of or destroying fungi, shall be injurious to vegetation upon which it may be used.

Sec. 4. The term "misbranded," as used in this act, shall apply to any insecticide or fungicide, or any article which shall enter into the composition of any insecticide or fungicide, the package or label of which shall bear any statement, design or device regarding such article or any ingredient or substance contained therein which shall be false or misleading in any particular, including any statement, design or device which shall be false or misleading as to the place of manufacture thereof. Any insecticide, other than Paris green or lead arsenate, and any fungicide shall be deemed misbranded: (a) When it shall contain arsenic in any of its combinations or in the elemental form and the amount of arsenic present shall not be stated on the label as the per centum of metallic arsenic; (b) when it shall contain arsenic in any of its combinations or in the elemental form and the amount of arsenic in water-soluble forms shall not be stated on the label as the per centum of metallic arsenic; (c) when it shall consist partially or completely of any inert ingredient which shall not destroy or repel insects or lessen the growth of or destroy fungi and shall not have the name and percentage amount of each of such inert ingredients plainly and correctly stated on the label; provided, in lieu of naming and stating the percentage amount of each inert ingredient, the producer may, at his discretion, state plainly on the label the correct name and percentage amount of each ingredient of the insecticide or fungicide having insecticidal or fungicidal properties and, make no mention of the inert ingredients except to state the total percentage thereof.

Sec. 5. The dairy and food commissioner and the director of the Connecticut Agricultural Experiment Station, acting jointly, shall make all necessary rules and regulations for carrying out the provisions of this act, such rules and regulations to conform, where possible, to the rules and regulations of the government of the United States authorized by the federal insecticide act of 1910. Upon complaint or information of a violation of any provision of this act, submitted by the Connecticut Agricultural Experiment Station, said commissioner and said director shall hold a hearing thereon, giving reasonable notice and opportunity

to any person accused of any violation hereof to be present and be heard. If said commissioner and said director shall be of the opinion that any person shall have committed a violation of any provision of this act, they shall place all evidence thereof which they shall have secured with any prosecuting authority having jurisdiction; but no person shall be penalized under the provisions of this act for selling or offering for sale any article of insecticide or fungicide in the original unbroken package in which it was received by him, provided he shall establish a guaranty by the wholesaler, jobber, manufacturer or other person residing in the United States, from whom any such article shall have been purchased, that such article is not adulterated or misbranded within the meaning of this act, which guaranty shall contain the name and address of the guarantor, but such guarantor shall be amenable to prosecution and penalties.

Sec. 6. Any person manufacturing, selling, offering or exposing for sale any insecticide or fungicide in violation of any provision of this act shall be fined not more than two hundred dollars for the first offense and not more than three hundred dollars for each subsequent offense.

Sec. 7. The Connecticut Agricultural Experiment Station or the dairy and food commissioner, or both, or their deputies, may, upon tendering the market price thereof, take duplicate samples from any lot, parcel or package of insecticide or fungicide which may be in the possession of any person. Each such sample shall be taken in the presence of the owner or his representative, and shall be sealed and properly marked for identification. One of such samples shall be left with the person from whom taken and the other shall be retained by the official taking the same, The Connecticut Agricultural Experiment Station shall annually analyze at least one sample of each brand of insecticide or fungicide so collected and such analysis shall include determinations of the active ingredients which the article contains, with such other determinations as may be deemed advisable. Results of such analyses shall be published in the bulletins of said Connecticut Agricultural Experiment Station, with such information regarding the character, composition and use thereof as may be of interest or importance. Such bulletins shall be issued annually or at such other intervals as may be deemed advisable.

Part II. Examination of Insecticides, Fungicides, Etc.

E. M. BAILEY*

INTRODUCTION

The Legislature of 1923 passed an act concerning the manufacture, sale and transportation of adulterated insecticides and fungicides. The text of the law and regulations, made as provided therein for its enforcement, are given in Part I of this report. Both the law and such regulations as have been made are substantially the same as the federal law and regulations so that articles of this class which satisfy the requirements of interstate commerce will be accepted in this State.

The law requires this Station to make analyses of samples which may be collected by the Dairy Commissioner or by our Station agent. Evidence of adulteration or misbranding is required to be reported to the Dairy Commissioner who is responsible for enforcement of the law. Analyses and such other information regarding the character, composition and use of these materials as may be of interest are required to be published in bulletins of this station, either annually or at other intervals as may be advisable. The law carries no specific appropriation for the inspection work and a complete survey of the entire field of insecticides and fungicides each year is not thought to be advisable or necessary.

An inspection was made in 1922 the results of which have been published.[1] Since then no general official inspection has been made but a few samples have been collected by our Station agent and others have been submitted by the departments of Entomology and of Botany of this Station and by others interested. Part II of this report gives the results of the examination of these samples.

The report includes a special analytical study of healthy and of diseased plants, chiefly tobacco. This work was done in collaboration with the Department of Botany in connection with their studies in vegetable pathology. Though not immediately connected with the purpose of this bulletin the results are recorded here as of interest.

CLASSIFICATION OF MATERIALS.

The samples analyzed may be classified as follows:

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*With the collaboration of Messrs. Andrew, Fisher, Nolan and Shepard.
1. Conn. Exp. Sta., Bull. 242, 1922.

Material	No. of samples.
Lead arsenate	3
Casein spreaders	5
Copper dusts, etc	4
Sulphur preparations	6
Nicotine preparations and tobacco	18
Tobacco, etc. healthy and diseased	12
Lime, for spraying	4
Miscellaneous	15
Total	**67**

METHODS OF ANALYSIS.

The methods of analysis employed are those authorized by the Association of Official Agricultural Chemists unless otherwise stated.

RESULTS OF INSPECTION AND ANALYSIS.

Arsenate of Lead.

21588. A sample of dry arsenate of lead was submitted by the department of Botany in connection with an investigation of foliage injury after spraying. The sample was of normal composition and the amount of water-soluble arsenic was not excessive.

Analysis: Total lead oxide (PbO), 63.34 per cent; total arsenic (As_2O_5), 32.16 per cent; water-soluble arsenic (As_2O_5), 0.30 per cent.

Two other samples were examined. One, **21437**, contained an excess of water-soluble arsenic, viz., 1.78 per cent. as As_2O_5, the limit for water-soluble arsenic being 1.50 per cent. The other sample, **23303**, was submitted for identification. It was shown to be lead arsenate containing only 0.50 per cent. of water-soluble arsenic as As_2O_5.

Casein Spreaders, "Calcium Caseinate."

Five samples representing three different brands have been examined.

Table I. Analyses of "Calcium Caseinate".

No.	Brand and Manufacturer	Nitrogen %	Casein (N x 6.38)	Lime (CaO)
22487	*A-7-ML* Casein Mfg. Co., New York	7.92	50.53	27.27
22601	*Kayso* California Central Creameries, San Francisco, Cal	3.26	20.80	48.25
22602	*Red Diamond* Rosin & Co., Philadelphia, Pa	2.98	19.01	55.26
22731	*Red Diamond* Rosin & Co., Philadelphia, Pa	3.36	21.44	52.56
22614	*Red Diamond* Rosin & Co., Philadelphia, Pa	3.59	22.90	44.11

These materials are mechanical mixtures of casein and lime in varying proportions and are not caseinates in the chemical sense of that term. They are used to facilitate the distribution of spray materials uniformly over the surface of foliage.

Four of the samples examined contain casein and lime in roughly the same proportions; the other sample shows a much greater proportion of casein.

Copper Dusts, Etc.

21416. *Niagara, D 25 Potato Dust.* Made by the Niagara Sprayer Co., Middleport, N. Y. This was guaranteed to contain 8.6 per cent. of copper (metallic), equivalent to 24.0 per cent. monohydrated copper sulphate; inert 76 per cent. Copper found was 8.9 per cent.

21414. *Dosch B-12 Green Copper Arsenic Dust.* Made by the Dosch Chemical Co., Louisville, Ky. The active ingredients guaranteed are copper (as metallic), not less than 5.75 per cent. and arsenic (as metallic), not less than 2.75 per cent. Copper found was 5.79 per cent. and arsenic 3.39 per cent. Arsenic is present as calcium arsenate.

20903. *Sanders' Dust.* Sample was submitted by a purchaser. It contained 6.10 per cent. of copper (as metallic), and 2.93 per cent. of arsenic (as metallic). Arsenic was found to be combined with calcium.

21264. *Bordeaux powder.* Sample sent by County Agent J. H. Fay. It was found to contain 14.34 per cent. of copper (as metallic).

Sulphur Preparations.

21415. *Niagara 90-10 Dusting Mixture (Pomodust).* Made by the Niagara Sprayer Co., Middleport, N. Y. The active ingredients declared were sulphur not less than 88 per cent., lead arsenate not less than 9.80 per cent., total arsenic (as metallic), not less than 1.95 per cent, and water-soluble arsenic (as metallic), not over 0.5 per cent.

Partial analysis showed 87.79 per cent. of sulphur, 1.84 per cent. of total arsenic (as metallic), and 0.24 per cent. of water-soluble arsenic (as metallic), which conforms substantially with the guaranty.

21413. *Niagara Soluble Sulphur Compound.* Made by the Niagara Sprayer Co., Middleport, N. Y. The sample examined was not an original package and the analysis does not fairly represent the composition of the fresh material. Polysulphides readily oxidize on exposure to air and pass into less active combinations. The composition of the original material was declared to be: sodium polysulphide 40 per cent., sodium thiosulphate, 18 per cent., free sulphur 3 per cent. and inert ingredients, 39 per cent. The amount of total sulphur found (41.4 per cent.), agreed closely

with that calculated from the ingredients declared, assuming polysulphide to be as pentasulphide, but its distribution was largely as thiosulphate and free sulphur. Directions properly caution against undue exposure of the material before using.

21417. *Niagara Dusting Sulphur. Sulfodust.* Made by the Niagara Sprayer Co., Middleport, N. Y. The material contained 92.4 per cent. of sulphur which conformed substantially to the guaranty of 93 per cent. with inert ingredients, 7 per cent.

22645. *Solbar.* Made by Bayer Company, New York. This is a "brand of barium sulphide compound for plant protection (polysulphide of barium)."

Analysis: Soluble in cold water 59.58 per cent; sulphide sulphur 15.04 per cent; thiosulphate sulphur 2.55 per cent; total soluble sulphur 17.59 per cent; total soluble barium (BaO), 43.42 per cent; insoluble sulphur 6.13 per cent; insoluble barium 9.35 per cent.

The soluble portion consists chiefly of barium sulphide or polysulphide and barium thiosulphate.

22697. *Colloidal Sulphur.* This was a sulphur paste, manufacturer unknown, containing 36.3 per cent. of sulphur.

22532. *Lime-sulphur solution.* This sample submitted by a purchaser was of average composition. It had a specific gravity at 15.6° C of 32 (Baumé), and contained 25.53 per cent. of sulphur.

Nicotine Products.

21258. *Niagara New Nicotine Contact Mixture D-1.* Made by the Niagara Sprayer Co., Middleport, N. Y. This dusting mixture is guaranteed to contain 1.25 per cent. of nicotine and 98.75 per cent. of inert ingredients. It contained 1.43 per cent. of nicotine (as alkaloid).

21129 and **21130.** *Nicotine dusts.* Samples were submitted by a purchaser. No. **21129** was a white powder containing 1.51 per cent. of nicotine (alkaloid); 96 per cent. of the material passed a 200 mesh sieve. No. **21130** was a brown powder which contained 0.72 per cent. of nicotine (alkaloid); 77.5 per cent. passed a 200 mesh sieve.

21831. *Axfixo.* Heightstown Hardware Co., Heightstown, N. J. Declared to contain not less than 1.25 per cent. nicotine; inert 98.75 per cent.

Analysis: Total ash 96.50 per cent; insoluble ash 1.28 per cent; lime (CaO), 31.85 per cent; magnesia (MgO), 23.57 per cent; nicotine 1.47 per cent.

On exposure to air in open container at room temperature the following amounts of nicotine were found at the intervals stated: After 24 hours 1.07 per cent.; 5 days, 0.35 per cent.; 10 days 0.18 per cent.; 15 days 0.12 per cent.

Tobacco.

Four samples of tobacco grown at the Tobacco Station at Windsor were examined as follows:

Table II. Analyses of Tobacco.

(Air-dry material)

No.	Material	Moisture %	Nitrogen %	Nicotine %	Potash (K_2O) %	Phosphoric acid (P_2O_5) %
19917	Broadleaf suckers..	4.06	3.85	0.68	....	1.00
19918	Leaves, shade grown	5.09	3.85	0.78	5.37	0.86
19920	Stalks, shade grown	5.09	1.72	0.26	3.69	0.45
19919	Havana..........	3.61	3.02	0.60	4.53	0.90

Six samples of tobacco grown at Storrs were analyzed for ash, nitrogen and nicotine. Results are given in Table III.

Table III. Analyses of Tobacco.

(Moisture-free basis).

No.	Material	Ash %	Nitrogen %	Nicotine %
22576	Rustica, without tops or suckers....	23.63	3.89	6.57
22577	Rustica, tops and suckers..........	29.16	3.05	2.49
22578	Rustica, with tops, without suckers.	25.52	3.22	4.90
22579	Rustica, without tops or suckers....	16.08	3.78	1.65
22580	Rustica, with tops, without suckers.	13.91	3.38	1.44
22581	Rustica, tops and suckers..........	17.68	4.13	1.38

Four other samples of tobacco were analyzed in connection with the study of a method for determining nicotine. One of these was smoking tobacco (Bull Durham), the analysis of which is as follows:

20175. Moisture 7.23 per cent; ash 14.03 per cent; ash insoluble in acid 1.42 per cent; phosphoric acid in soluble ash 3.68 per cent; nitrogen 2.20 per cent; nicotine 2.60 per cent.

Comparative Analyses of Healthy and of Diseased (Calicoed) Leaves of Tobacco, Tomato and Petunia.

These analyses of normal and of calicoed leaves were made primarily for the benefit of the Department of Botany of this Station in connection with their studies in plant pathology.

The leaves were selected from relatively the same positions on the stalks in order that they might be of as nearly equal age and development as possible. The material was then dried in a current of warm air and the air dry substance used for analysis. Results were calculated (a) to the basis of the fresh green leaf, and (b) to the water-free material.

Generalities cannot, of course, be based upon such a limited number of analyses. The natural variations which may occur in the composition of healthy leaves and of diseased leaves must be

reasonably established before attempting to compare the one type with the other too minutely. However, the analytical data, which is in some detail, is of interest. The nitrogen content of all the diseased plants was found to to be higher than that of the healthy leaves; and it generally holds that the carbohydrates are lower in the diseased leaves. Making allowance for ash insoluble in acid (sand, etc.), the results indicate that the diseased leaves are somewhat poorer in mineral constituents than the healthy leaves but the evidence is not altogether consistent. Differences between the separate ash constituents are either so inconspicuous as to magnitude, or so inconsistent as to value (+ or −), that no exact conclusions seem warranted. Analyses are given in Table IV.

Two other samples of healthy and of diseased leaves of tobacco were analyzed less completely as follows:

	Healthy leaves 19992 %	Calicoed leaves 19993 %
Moisture	4.88	4.98
Ash	23.33	18.82
Nitrogen	3.36	5.34
Nicotine	0.96	0.92

Lime for Spraying.

Four samples were submitted by purchasers chiefly to determine whether they contained much magnesia. For spraying purposes calcitic lime is preferred. Three of the samples examined were of the dolomitic type, containing 28 to 32 per cent. of magnesia (MgO).

Miscellaneous Materials.

20808. *Schnarr's Insecticide.* Made by the Van Antwerp Drug Corporation, Mobile, Ala.

Analysis: Moisture 33.68 per cent; ash 1.44 per cent; total fatty acids 8.25 per cent; free fatty acids (as oleic acid), 0.77 per cent; mineral oil 49.13 per cent.

The preparation is a paste consisting of, or containing, mineral oil emulsified with soap. Other active ingredients, if present, not identified.

20715. *Keresol.* Claasen, Murfit and Co., Philadelphia.

Analysis: Ash 1.30 per cent; phenol 4.15 per cent; light oil (kerosene), 80 per cent; residual (largely soap), 12 per cent (approx.).

The partial analysis indicates that the preparation consists essentially of an emulsion of kerosene and soap containing phenol.

20716. *Sun Miscible Oil.* Sun Co., Boston and New York.

Analysis: Ash 2.85 per cent; unsaponifiable 79 per cent; saponified fatty material 16 per cent.

TABLE IV. ANALYSES OF HEALTHY AND DISEASED LEAVES.

	Havana Tobacco				Cuban Tobacco			
	Healthy 21790A		Calicoed 21791A		Healthy 21792A		Calicoed 21793A	
	% Fresh	% Water-free	% Fresh	% Water-free	% Fresh	% Water-free	% Fresh	% Water-free
Moisture	88.91	00.00	88.36	00.00	84.72	00.00	84.21	00.00
Ash	2.32	20.91	2.34	20.06	3.18	20.79	3.38	21.41
Nitrogen	0.43	3.88	0.56	4.84	0.63	4.09	0.74	4.67
Nicotine	0.21	1.88	0.21	1.79	0.34	2.25	*	*
Carbohydrate:								
Starch	....	....	0.24	2.03	0.26	1.71	0.24	1.54
Sol. carbohydrate as dextrose	0.70	6.33	0.72	6.16	1.26	8.23	1.03	6.54
Insoluble in acid	0.11	0.95	0.08	0.68	0.49	3.18	0.72	4.57
Iron and Aluminum ($Fe_2O_3+Al_2O_3$)	0.04	0.32	0.02	0.21	0.09	0.60	0.11	0.67
Manganese (Mn_3O_4)	0.02	0.15	0.01	0.09	0.02	0.10	0.01	0.06
Magnesium (MgO)	0.17	1.49	0.16	1.36	0.20	1.31	0.21	1.30
Calcium (CaO)	0.54	4.90	0.53	4.58	0.70	4.59	0.70	4.42
Potassium (K_2O)	0.72	6.53	0.72	6.23	0.77	5.03	0.71	4.52
Phosphoric acid (P_2O_5)	0.09	0.78	0.10	0.88	0.13	0.84	0.14	0.90
Sulphuric acid (SO_3)	0.20	1.81	0.16	1.35	0.21	1.39	0.19	1.22

* Sample too small, all used for other determinations.

TABLE IV. ANALYSES OF HEALTHY AND DISEASED LEAVES—(*Continued*)

	Broad Leaf Tobacco				Tomato				Petunia			
	Healthy 21794		Calicoed 21795		Healthy 21803		Calicoed 21804		Healthy 21856		Calicoed 21855	
	% Fresh	% Water-free	% Fresh	% Water-free	% Fresh	% Water-free	% Fresh	% Water-free	% Fresh	% Water-free	% Fresh	% Water-free
Moisture	86.61	00.00	86.73	00.00	84.72	00.00	85.23	00.00	80.26	00.00	81.01	00.00
Ash	2.46	18.33	2.58	19.45	3.85	25.20	3.18	21.50	4.38	22.14	4.74	25.07
Nitrogen	0.60	4.49	0.67	5.07	0.54	3.52	0.68	4.61	0.45	2.28	0.55	2.92
Nicotine	0.35	2.63	0.36	2.70	....	....	....	....	....	....	....	....
Carbohydrate:												
Starch	0.26	1.97	0.20	1.51	0.19	1.24	0.15	1.01	0.14	0.73	0.12	0.62
Sol. carbohydrate as dextrose	0.84	6.28	0.66	4.95	0.77	5.05	0.76	5.17	0.99	5.01	0.69	3.65
Insoluble in acid	0.12	0.92	0.28	2.12	0.23	1.53	0.31	2.11	2.46	12.44	2.63	13.91
Iron and Aluminum ($Fe_2O_3+Al_2O_3$)	0.03	0.23	0.05	0.40	0.05	0.34	0.03	0.21	0.39	1.96	0.38	1.99
Manganese (Mn_3O_4)	0.01	0.07	0.01	0.08	0.01	0.09	0.01	0.08	0.01	0.06	0.03	0.14
Magnesium (MgO)	0.16	1.20	0.17	1.29	0.24	1.55	0.21	1.41	0.12	0.61	0.13	0.69
Calcium (CaO)	0.52	3.88	0.57	4.27	1.06	6.95	0.82	5.53	0.26	1.31	0.23	1.24
Potassium (K_2O)	0.79	5.90	0.70	5.27	0.80	5.24	0.77	5.20	0.69	3.51	0.81	4.29
Phosphoric acid (P_2O_5)	0.10	0.76	0.10	0.75	0.09	0.62	0.12	0.82	0.14	0.73	0.16	0.84
Sulphuric acid (SO_3)	0.14	1.06	0.13	0.99	0.52	3.41	0.42	2.83	0.08	0.42	0.08	0.43

This preparation appears to be a mixture of mineral oil and a sodium soap.

22855. *Verm-O-Spray.* Verm-O-Spray Products Co., West Haven, Conn.

Analysis: Sp. Gr. at 15.6° C. 0.8825; ash trace; flash point 61.0°C (142°F); fire point 64°C. (147°F); salicylate present.

This preparation consists of, or contains, chiefly kerosene and methyl salicylate. Other active ingredients, if present, not identified.

20811. *Roach Liquid.* The Pied Piper Service, Providence, R. I.

The sample submitted appeared to be largely kerosene and methyl salicylate. Other active ingredients, if present, were not identified.

20809. *Roach Powder.* The Pied Piper Service, Providence, R. I.

Analysis: Moisture 14.57 per cent; nitrogen 0.5 per cent, equivalent to protein 3.13 per cent; starch 13.73 per cent; ash 40.60 per cent; sodium oxide (Na_2O), 18.89 per cent; boron oxide (B_2O_3), 18.32 per cent; chlorine 5.12 per cent; silica, iron, sulphate, phosphate, traces.

The preparation consists essentially of a cereal, or other starchy material, with borax and salt. Active ingredients other than borax, if present, were not detected.

20112. *Herbicide.* Reade Manufacturing Co., Jersey City, N. J. This is sold as a weed exterminator. It is a green alkaline solution.

Analysis: Solids 31.09 per cent; arsenic (as As_2O_3), 24.30 per cent; sodium arsenite ($NaAsO_2$), calculated from $As_2O_3 = 31.9$ per cent.

The preparation is essentially a solution of sodium arsenite.

21127. *Be-Health.* General Laboratories, Madison, Wis. This is a special sodium hypochlorite solution prepared for treating foul brood in bees. Active ingredients declared 8.50 per cent; inert 91.50 per cent.

Analysis: Available chlorine 3.77 gms. per 100 cc.; total chlorine 3.81 gms. per 100 cc; sodium hypochlorite (NaOCL), equivalent to available chlorine 3.96 gms. per 100 cc.; sulphates trace; calcium none.

Available chlorine determined 33 days after the first analysis was made showed 3.70 gms. per 100 cc., indicating practically no deterioration in that length of time. During the interval the solution remained corked in the original container at ordinary room temperature. Assuming the active ingredient to be sodium hypochlorite the guaranty is more than twice as high as it should be.

20391 and **20404.** *Qykade.* The Chlorine Products Co., New York. Solution of chlorine.

Analysis: **20391.** Total solids 1.26 gms. per 100 cc.; available chlorine 0.40 gm. per 100 cc; total chlorine 0.71 gm. per 100 cc; lime (CaO), 0.64 gm. per 100 cc. **20404.** Available chlorine 0.37 gm. per 100 cc.

Available chlorine determined in **20391** about 40 days after the first analysis showed available chlorine of 0.37 gm. per 100 cc. The solution contains a mixture of calcium hypochlorite and calcium chloride.

21714, 21834. *Star Water*; and **21837** *Wescco Bleaching Water.* These are disinfectant and bleaching solutions the active agent being the available chlorine which was determined to be 2.43, 2.84 and 2.89 gms. per 100 cc., in the order named. The Wescco product bore no statement of active ingredient.

20459. *Unknown material* submitted for identification was found to be copper cyanide.

20810. *Rat exterminator.* This was a preparation with a cereal or starchy base in which the active ingredient was not identified. No alkaloidal poisons were detected.

BULLETIN 259 JULY, 1924

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

Corn in Connecticut

Figure 17. Harvest time in Southern Connecticut.

The work herein reported was conducted as a joint project of the two Connecticut Experiment Stations, and therefore will appear in the Annual Reports of both Stations.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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July, 1924.

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Corn in Connecticut.[1]

D. F. JONES, W. L. SLATE,[2] AND B. A. BROWN.[2]

Connecticut stands in the unique position of having the highest average yield of corn per acre although it is well removed from the center of largest production. In the amount of corn raised Connecticut is exceeded by 35 other states. Within the state corn occupies a greater area than any other cultivated crop. The amount of land devoted to the more important crops, in thousands of acres, is approximately as follows: hay 330, corn 67, tobacco 27, potatoes 18, other vegetables 9, oats 11, rye 5, buckwheat 2.[3] The value of the corn crop in Connecticut, worth about six million dollars in 1919, is usually exceeded about three times by tobacco, two times by hay and nearly equalled by vegetables and by fruits. The three other cereals of any importance, oats, rye and buckwheat, combined do not ordinarily amount to much more than one tenth of the value of corn. The relatively high average yield of corn per acre is due largely to the small size of individual fields, to the usually ample rainfall and the general practice of fertilizing corn liberally. The high humidity which commonly prevails during the pollination period favors a full setting of grain on the ears. All these factors tend to overcome the disadvantage of a short growing season and low temperatures during the earlier part of the growing season which retard the growth of corn.

CLIMATIC ZONES.

The southern edge of the state along the sound and considerable areas along the river valleys extending well into the state have much the same climatic conditions as the main corn growing region of the mid-west. This is shown by the biological zones, as mapped by the U. S. Biological Survey, which are based upon areas occupied by the same or closely related species of wild plants and animals. While these zones are somewhat arbitrarily defined they give perhaps the best guide to the natural climatic and soil conditions which govern the growth of plants. The upper Austral zone, as it is called, in the humid section includes practically all of Iowa, Missouri, Illinois, Indiana, Kentucky, Ohio, parts of the central states east of the Appalachian mountains and extending through New Jersey and Long Island to the area bordering the sound in New York and Connecticut and extending inland in the larger river valleys.

This explains why many of the large dent varieties from the west are often grown successfully for grain in Connecticut. But

[1]The scope of this corn survey was planned by W. L. Slate and H. K. Hayes. Much credit is due B. G. Southwick and Henry Dorsey for the location of varieties and obtaining the facts concerning their history and development.

[2]Agronomists at Storrs Station.

[3]Fourteenth Census Vol. VI, part 1, figures for 1919.

these varieties when grown for any length of time are considerably modified in size, ear shape and kernel type and in time of ripening either by direct seed selection or by natural selection. The typical western dent type favored in the past is not adapted to New England conditions. The kernels are too deep and compact on the ears to dry out well in our moist climate. The texture of the kernel is softer than our flint or smooth dent varieties, consequently the ears mold easily and the seed germinates poorly the following year. Since the smooth, hard-kerneled ears with shallow grains spaced widely on the ears have been found to give plants which ripen earlier and often yield as much or more than the compact, deep rough-grained types, these more flint like types have been favored.

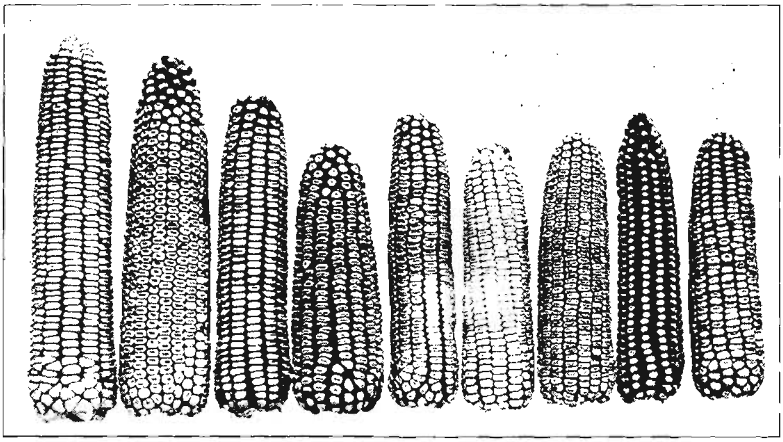

Figure 18.

Representative ears of different types of dent corn commonly grown in New England. They are from left to right; Eureka, Connecticut Dent, Century, Golden Dent, Lakeside, Sharon White Cap, Early Wonder, Holcomb's Dent and Early Huron.

Types of Corn Grown in New England.

Along with the recently introduced western varieties and the better adapted New England dent types derived from these, there are the typical eight-rowed yellow and white flint corns grown by the Indians in New England when the Mayflower landed and still widely planted. Flint corn has long been grown in this section and is well adapted to a short season and ripens when dent varieties are too wet to crib satisfactorily. The hard shallow kernels dry out quickly, consequently the seed is not easily injured by frost in the fall and germinates well the following spring. For these

reasons flint corn is the most dependable kind of corn to grow in the northern part of the state, at high elevations and in places where the frost comes early in the fall.

Many variations from the typical eight rowed flint type exist. There are very long eared varieties, others with very large seeds, and still others with small seeds having ten, twelve or fourteen rows of grain on the ear. Color varies from yellow to white in the endosperm or seed proper and from colorless to brownish or dark red in the hulls or pericarp. In addition to the typical dent and flint varieties there are a number of intermediate types having characteristics of both dent and flint corn. These have every evidence of being hybrids between dent and flint varieties which have been maintained as intermediate types.

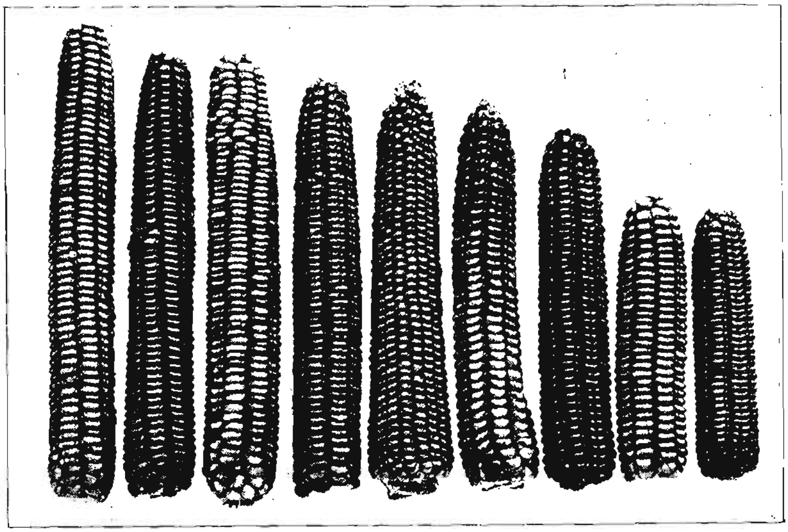

Figure 19
Types of flint corn commonly grown in New England. They are, from left to right; Sanford White, Longfellow, Mammoth White, Burwell's Yellow, Dutton, Smut Nose, King Philip, Rhode Island White Cap, and Griswold's 90 Day.

On account of its geographical position on the border line of two biological zones, with its varied topography, soils, and seasonal conditions Connecticut has probably as many distinctly different varieties of corn as any section of the country. Many of these varieties of widely different type grow equally well in any one locality. Since practically all of the corn is used on the farms where it is grown there are no market requirements to meet which in other places tend to limit the number of varieties to a few belonging to one type.

The Need of a Variety Test.

On account of the great diversity in varieties of corn grown in this part of the country it is often a problem to know which is the best variety for any particular place. In order to make an intelligent selection it is necessary to know the length of the growing season, the soil requirements and the general character of the different varieties. Many varieties suitable for silage are not at all suitable for husking. And many good varieties for grain are unprofitable to use for silage. Since there are so many differences in the varieties of corn now grown it may be expected that some varieties exist which are inherently more productive for a given locality than other varieties requiring the same length of growing season. Since corn, like every other plant, varies pro-

Figure 20.
The variety test field at the Mt. Carmel farm.

foundly with the soil, the season, and the the treatment given, the only way to find out the high yielding varieties is to grow them side by side and compare their production under equal conditions. In this way valuable material is found with which breeding operations can be conducted for the purpose of further increasing the capacity of corn to yield.

In 1914 the two Agricultural Experiment Stations, at New Haven and at Storrs, planned a co-operative corn survey and variety test. The aim was to locate the most promising varieties in every part of the state and test these long enough to find out their ability to yield in different parts of the state and their suitability for different purposes. In carrying out this plan practically the whole state has been covered and varieties located by inquiring whenever a promising field of corn was seen. The county agents have helped

greatly in giving the names and location of promising varieties. The local and state fairs have also been used to get the names of growers of corn in Connecticut. Some varieties from adjoining states have been included as well as a few from the west and south. The latter have been tested mainly for silage purposes.

On account of limitation of ground upon which the tests have been conducted it has not been possible to include every variety grown in the state. It is also quite possible that not all of the best varieties have been included. But since the test has covered nine years, new varieties being added each year, most of the better varieties have been included.

As much information as possible has been obtained concerning each variety—its origin, where grown, how selected and the purpose for which it has been raised. This together with a brief description is given for each variety or strain. In most cases very little is known about the history of a variety of corn.

Origin of Varieties of Corn.

There are many indications that corn has been grown on the American continent for many centuries previous to the coming of the white man. Corn was the principal food crop of the Indians and the main types of corn grown to-day developed in the hands of the original inhabitants. Flint corn was grown in the northeastern states and in Canada. "Gourd seed" corn, the forerunner of the modern dent type was found in Virginia and the soft floury type was employed in the west. Sweet and pop corn were used to a limited extent by some Indian tribes. How these widely different types developed and what was the wild ancestral parent of cultivated corn will probably always remain in obscurity.

Many flint varieties grown to-day differ in no essential way from specimens that have been found in prehistoric Indian remains. Probably the modern dent type with its cylindrical ear and deep compact grains, completely covered tips and well filled butts as exemplified in the prize winning specimens at the western corn shows is a recent development. It is a product both of extensive selection towards a certain standard combined with the very best conditions for growth made possible by improved methods of tillage.

The Indians were skilled in the culture of corn as shown in the reports of the early explorers. There is no way of knowing whether present day varieties are inherently more productive than those of early times. In the early chronicles, yields were never stated in terms of units of land and no distinction was made between measures of ears or of shelled grain. A competitive trial of twentieth century varieties with fifteenth century varieties would be of interest but unfortunately such a test will never be conducted. The best that can be done now is to compare the flint varieties

which have presumably changed least with dent varieties which apparently have changed most.

Very little is known as to the history and origin of the varieties grown at the present time. The common practice of changing seed and the ever present cross-pollination and natural selection which changes varieties in a few years have made it difficult to trace the history of varieties many years back. The origin of some of the most widely grown varieties in the west is typical of the way in which new varieties are developed. In 1846, Robert Reid moved from Ohio to Tazewell County, Illinois, bringing with him

Figure 21.
Flint corn has changed but little since it was grown by the Indians.

seed of a local variety known as Gordon Hopkins' corn. The first year this was planted in Illinois it did not thoroughly mature, consequently the seed did not germinate well the following year. Missing hills were replanted with an early variety known as Little Yellow corn. The corn has not been purposely mixed since then and by selection the type of Reid's Yellow dent, the most widely planted variety in this country, has been developed.

The improvement of the famous variety of corn known as Leaming was begun about 1856 in southern Ohio with the use of

several local varieties commonly grown in that region. It is stated that different kinds of corn were used including some with purple or black seeds. Leaming is one of the first dent varieties of modern type to be developed and is a truly remarkable instance of plant improvement through hybridization followed by systematic selection. To-day many different strains of Leaming are grown. There is as much difference between Leaming grown for a number of years in New England and the western Leaming as between other varieties of different origin. On account of the continual cross-pollination going on with corn and the resultant germinal heterogeneity the word variety as applied to corn cannot have the same significance as applied to other crops such as wheat, beans or tobacco, which are largely self-fertilized and generally remain true to type. The vegetatively propagated plants such as potatoes,

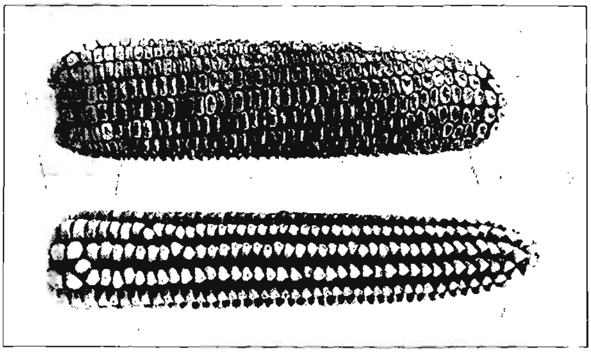

Figure 22.
Extreme types of dent corn.

berries and tree fruits also come true to type as long as they are not propagated by seed and varieties of these can be described with considerable accuracy. A variety of corn on the other hand is a collection of plants that are often exceedingly diverse. In every field of corn ears can be found which resemble many other varieties. This great variability makes it possible to select for almost any desired type, and if the selection is systematically carried out there will be a gradual change in that direction.

Smooth and Rough Grained Dent Varieties.

Many western dent varieties are being continually brought to Connecticut and grown for silage and sometimes for husking. As a grain corn they usually do not ripen early enough to be entirely satisfactory except in favorable seasons. If they continue to be grown they are naturally selected for earlier maturity. The ears

that mature properly for seed have shallower kernels, the rows of grain are spaced farther apart on the cob and the grains are smoother and harder. In other words the extreme dent type tends to become more and more flint like. Many farmers look upon this as a process of degeneration and after growing the corn for several years say that it has "run out" and get fresh seed from the west. The western seed will usually give a heavier growth of stalk because the plants mature later and in those places where such types can be brought to the hard dough stage they may be better for silage purposes than earlier ripening sorts that have become better adapted. Our tests show that the adapted varieties are superior as a general rule for grain than any varieties introduced from outside the state so far tested. While the deep kerneled, compact-eared, rough seeded dent type favored in the central corn growing states carries a large proportion of shelled corn to the ear such types do not necessarily produce the heaviest yields per acre. Even in many places in the west, tests have shown the smooth, hard seeded shallow grained dent types yield somewhat better than the types favored in the corn shows. Kiesselbach* at the Nebraska Station found that as an average of two varieties smooth seed ears produced about six per cent. more than rough seed ears. In all except the most favored corn growing sections and particularly in the north, the natural tendency for corn to vary away from the extreme dent type seems to be in the direction of greater efficiency. This is expressed not only in a better quality of corn but in greater yield of dry grain.

Types of Flint and Dent Corn.

Several fairly distinct types of flint corn are grown in Connecticut; the eight rowed, medium sized, yellow Canada flint; the reddish King Philip; the Rhode Island White Cap which is similar in type but differs in color of the grain; the ten to fourteen rowed small seeded Yellow Dutton; the long eared, eight rowed yellow Longfellow, and the similar type of Sanford White which differs in color; the large seeded, heavy cobbed Mammoth White and Mammoth Yellow flints and the still larger and coarser Gold Nugget.

Dent varieties are even more diverse and types intergrade so that it is difficult to make any clear distinction. Dent corn differs from flint in having a larger number of rows of grain on the ears and in having more soft starch in the seed. This soft starch is placed at the top of the kernels and on drying shrinks more than the hard starch at the sides and base of the kernel so that the characteristic indentation is formed in the mature seeds. In some yellow varieties this soft starch remains uncolored giving the ears a characteristic appearance generally spoken of as White Cap

*References to publications cited are given at the end of this bulletin.

corn. White Cap as applied to dent varieties should not be confused with the same term in Rhode Island White Cap Flint as in this variety the term "Cap" merely refers to the fact that the ears are usually well covered at the tips.

The dent varieties most commonly grown in Connecticut are derived from Leaming or similar types. They are characterized by medium to large tapering ears, with moderately smooth, hard kernels. The ears are not as compact as the western Leaming and carry a moderate proportion of grain to the cob. Similar varieties to these have been derived from Reid's Yellow Dent, Funk's 90 Day, Sutton's Yellow Dent, and other varieties. They vary greatly in size of ear, in the spacing between the rows and in the smoothness and hardness of the kernels. Another commonly grown type of dent is the White Cap corn. A number of varieties of this type have been secured from various parts of the state. The

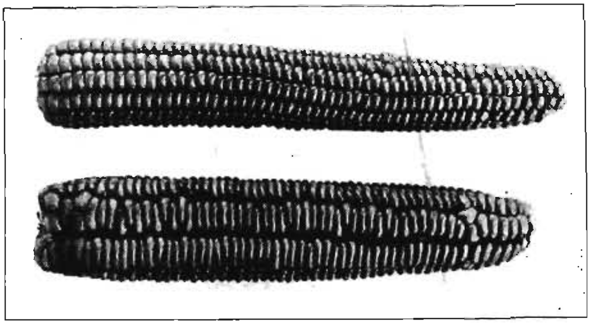

Figure 23.
Extreme types of flint corn.

ears are usually smaller than the Leaming types, but the ears carry a high proportion of grain to the cob. Many White Cap varieties ripen well and are good yielders.

Another type of dent corn is represented by such varieties as Century Dent, Early Michigan, Early Huron, Dowd Dent and other varieties. The ears are medium in size and usually tapering. The kernels are broad, smooth, hard and bright and have very little soft starch so that the indentation is not pronounced. The kernels are also shallow and rounding and there are wide spaces between the rows. These varieties ripen satisfactorily in practically every season and give good yields of high quality corn. They are well adapted to southern New England conditions. They combine many of the desirable features of flint corn with dent, habit of growth and yielding capacity.

A host of other varieties including white dents, golden dents and many other diverse kinds of dent corn are grown but cannot be

classified in any group. There are also varieties intermediate between dent and flint such as Luce's Favorite and Hickory King. The former has every indication of being a recent hybrid between dent and flint corn and is quite variable.

Source of Seed.

As far as possible seed has been obtained each year from the original grower. The practice has been to obtain from ten to twenty ears at harvest time either from the stalks in the field or from the crib shortly after husking. No extensive selection of

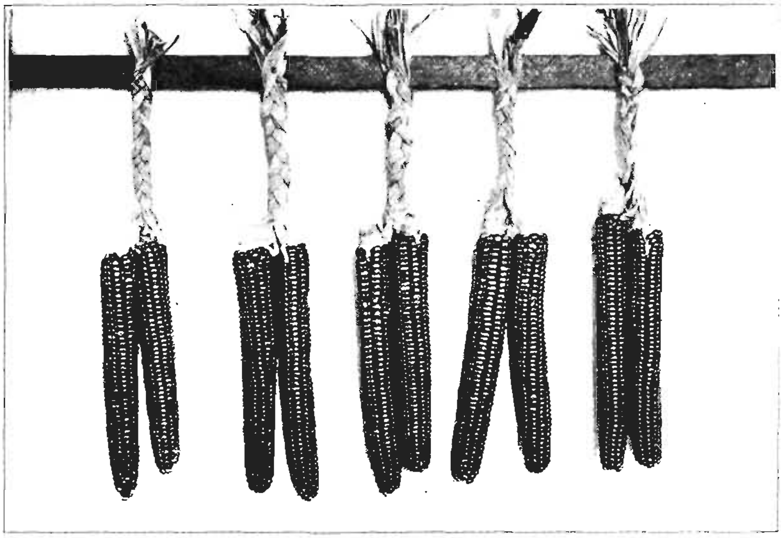

Figure 24.
One farmer's method of hanging seed ears.

seed ears was made, the endeavor being to obtain good ears representative of the variety, such as the grower would sell for seed if he were putting out any quantity. The seed ears in most cases were not show ears but were generally as good as the grower would use for his own planting. Experience has shown that there is very little correlation between the appearance of the seed ears and the crop grown from them. Since ten or more ears were obtained from different parts of the field, seldom more than one ear from a shock, it is thought that the seed represented the variety fairly. Most of the seed from out of the state was sent by the grower or dealer and was already shelled. Nothing is known as to how this seed was selected. Enough seed was ob-

tained in each case so that it was fairly representative of the variety.

Whenever one year old seed was not available two year old seed has been used but in no case has seed older than this been used. It is hardly necessary to say that no seed was saved from the trial plots since cross-pollination alters the nature of the crop grown from that seed so that it would no longer represent the variety. The seed ears were dried in a heated room and stored above freezing temperature. When thoroughly dried all the ears of one variety were shelled together and the seed well mixed. It was then divided, one half being used for planting at the farm of each Station.

Where the Tests Were Conducted.

The Mt. Carmel farm is situated about ten miles inland from the shore at a moderate elevation on soil that is classified as Wethersfield Sandy Loam. The air drainage is such that the corn is seldom damaged by the first frosts in the fall. The growing season is therefore extended a week or more beyond the time that corn is frosted in the adjacent valleys.

On this farm corn has been planted from the 20th to the 25th of May and cut during the latter part of September or first half of October. The land used for the corn variety tests is typical of much of the upland soil in Connecticut and is fairly representative as to fertility. The fields have been rotated with various other crops, principally clover and timothy and potatoes. Corn has usually been grown two years in succession. About ten tons of manure to the acre have been used together with applications of commercial fertilizer of about a thousand pounds per acre of a 4-8-4 formula although the amounts and composition have varied from year to year. The aim has been to have the corn land representative of the average corn land in the state in fertility.

The station farm at Storrs is in the eastern highland 35 miles from the sound. The soil is Gloucester Fine Sandy Loam, a well drained soil of rather low natural fertility. It is typical of much of the eastern portion of the state. The air drainage is good and corn is not affected by the earliest frosts. The rotation and fertilization practice has been much the same as at Mt. Carmel. The two places in different parts of the state and in different biological zones make possible an interesting comparison of the behavior of the same varieties grown under different conditions.

Method of Testing the Varieties.

The plan has been to grow each variety in both places at least three years. Since varieties perform differently in different seasons it is necessary to have more than one year's results upon which to base reliable conclusions. In some cases varieties have

shown up so poorly the first or second year grown that it has not seemed worth while to test them further so they have been dropped. In many cases it has been impossible to secure seed because the farmer stopped growing the variety and no other source of similiar seed could be located. In general the practice has been to continue every variety that ripened satisfactorily and of which a supply of seed seemed assured, for at least three years. The more promis-

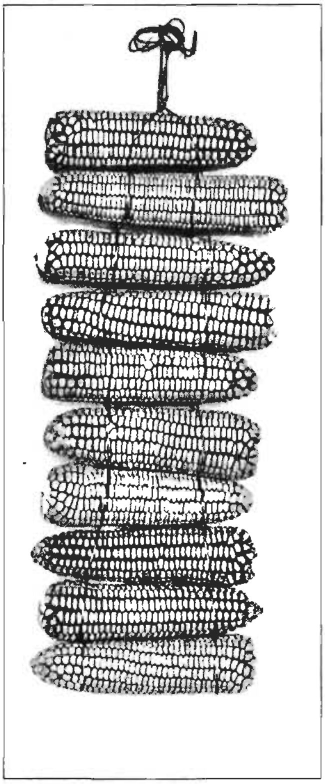

Figure 25.
A convenient method of hanging seed ears.

ing varieties were grown throughout the experiment while those that yielded poorly or were unsatisfactory for other reasons were discontinued after being tested three years. However the number of years a variety has been grown is not a reliable index of its desirability as many good varieties were not included in the test until the later years.

Planting System.

The usual practice has been to plant each variety in single row plots, grouping together varieties of the same type, size and length of growing season. Each variety has been planted in at least two plots in different parts of the field and as far as possible the plantings have been replicated three times. Single row plantings are subject to a competitive effect which is not present when the varieties are grown by themselves. A tall, large, late growing variety planted along side of a smaller and earlier variety will tend to have an advantage because it will receive more sunlight and will have less root competition than it would have growing in a field planted to this one variety. Consequently its yield may be higher than it would otherwise be. In the same way the yield of the smaller variety may be reduced below what it would be if it were not competing with the larger variety. Kiesselbach at the Nebraska Station compared two widely different varieties of dent corn and found that the larger and later variety in the single row trials yielded 105 per cent. more than the other variety whereas, when planted in blocks of three rows and the yield based only on the center row, it yielded only 52 per cent. more as an average of two years' trials. However, this example is an extreme case. Varieties of similar habit of growth do not show such a competitive effect. In 1915 three row plots were used at both stations. If there was a pronounced competitive effect between adjacent rows of different varieties the yields of the large and later varieties in the outside rows of the three row plots would tend to be higher, while the yield of the smaller and earlier varieties would be lower, than the center row of each plot which is presumably free from influence by the other variety. Consequently the yields of the two outer plots should be more variable than the yield of the center plot for the variety test field as a whole. The coefficients of variability calculated for each of the three rows for 69 varieties are 13.93 ± 1.75 and 15.01 ± 1.89 for the two outer rows and 13.93 ± 1.75 for the center row. In this case there was no significant difference so there was apparently no marked competitive effect. For this reason the three row plots were not used after 1915. Planting in single rows permitted more replications. The order in which the varieties were planted was changed in each replication so that the same varieties were not grown adjacent to each other. Flint and dent varieties were grown separately with a guard row where plots adjoined. For these reasons it is believed that competitive effect is not a serious factor for error in these trials although in some cases it has tended to exaggerate the differences. In any case there can be no effect unless the varieties differ in capacity to produce and it was mainly to establish this fact of a difference in varieties that the corn survey and variety trials were conducted.

Cross Pollination.

Since all of the varieties were grown in the same field, cross pollination took place freely between varieties which tasseled and silked at the same time. This was shown by the large number of yellow kernels produced on white seeded varieties. Cross-pollination can have no effect upon the plant itself but it does effect the seeds immediately resulting from the cross-pollination. Of course the plants grown from these crossed seeds would be greatly altered but since no seed was saved from the test fields this can be left out of consideration. A number of investigators have shown that cross-pollination between different varieties increases the weight of the crossed seeds as compared to the self-pollinated seeds on the same ears and this tends to increase the yields in mixed plantings.

Figure 26.
Variation in size of different varieties of dent corn.

Carrier compared the yield of four strains of Boone County White corn from different sources grown separately and mixed together. The four strains when grown in such a way that inter-pollination was prevented gave an average of 20.9 bushels per acre while an equal mixture of seed of the four strains yielded 32.4 bushels in a two year test. Similarly four strains of Leaming grown separately gave 26.0 and in mixture 40.4 bushels. It is difficult to account for these large increases of 55 per cent in each case as due to hybrid vigor in the seed. Kiesselbach has made a very careful comparison of cross and self-pollinated seeds on the same ears from a number of different varieties and found an increase of only 22 hundredths of one per cent.

Results obtained at the Connecticut Station show that increase in the weight of seed due to cross-pollination is an indication that

the plants are poor yielders. Cross-pollination between inbred strains that were much reduced in yield gave increases ranging as high as 35 per cent. Cross-pollination between first generation hybrids which were vigorous and yielded well gave smaller increases in weight of cross-pollinated seeds not exceeding ten per cent whereas the highest yielding type of all did not give any increase in weight when cross-pollinated with a distinctly different variety. If this is generally true, mixed plantings as in variety tests would tend to increase somewhat the yield of the poorer-yielding varieties and in this way might be misleading. It seems more probable that the increased yield from mixed plantings is due to a more complete pollination and consequently a heavier setting of seed rather than increase in weight of seeds due to hybrid vigor. This would affect all varieties alike presumably except the earliest and latest varieties.

Planting, Harvesting and Computing Yields.

The varieties grown for grain have been planted in hills three feet apart each way and thinned to three stalks to the hill. The plots have varied from 66 to 150 feet in length in different years according to the size of the field and the number of varieties planted. The corn was cut as soon as ripe and put into shocks. When husked and weighed a sample of about 15 pounds was taken from each lot and dried in a steam heated room to a constant weight. A composite sample was then taken from all the varieties to find the amount of moisture still remaining. From this the yield in bushels of shelled corn per acre with 12 per cent moisture was calculated for each plot, using 68 pounds of ear corn equivalent to one bushel of shelled corn. Throughout the test field every fifth plot was planted with one variety as a check to indicate differences in productiveness in different parts of the field. The theoretical check yield was calculated for each row from the yields of the two check plots on each side by increasing or decreasing the difference uniformily in the intervening rows. At Mt. Carmel the difference in the yield of the variety and the theoretical check yield was then added to or subtracted from the average of all the check rows to give the final yield. This procedure may be illustrated as follows:

Plot Number	Corn Grown	Actual Yield	Theoretical and Actual Check Yield	Difference between actual yield of corn tested and theoretical yield of check.	Corrected yield obtained by adding or subtracting this difference to the ave of all check plots grown
1	check	50	50	0	52.5
2	variety A	75	51	+24	76.5
3	variety B	70	52	+18	70.5
4	variety C	40	53	−13	39.5
5	variety D	50	54	−4	48.5
6	check	55	55	0	52.5

In this way the yields obtained in one part of the field can be compared with the yields in other parts of the field. After correcting for place variation in this way the yields of the different plots of the same variety have been averaged. At Storrs the actual yields were compared with the theoretical check yields on a percentage basis.

In the silage test the varieties have been planted in drills, at Mt. Carmel, spacing the plants one foot apart in the rows, with the rows three feet apart. The varieties were cut at different times as they matured. At Storrs all varieties were planted in hills and cut at the same time which was usually shortly before or shortly after the first killing frost. The plants were weighed as soon as cut

Figure 27.
A field of flint corn in Kent.

in the field and a sample obtained by taking every tenth stalk in the row. This was chopped and dried to absolute dryness and the per cent of moisture calculated from this. The yield in green weight per acre was obtained for each plot, corrected to the check plots and averaged. The yield of dry matter per acre was then calculated by multiplying this average by the average per cent of dry matter in the samples of that variety.

Discussion and Analysis of the Results.

The results obtained from growing the varieties at Mt. Carmel and at Storrs from 1914 to 1922 are given in the accompanying tables. The number of years tested, the color of the seed, the relative maturity, the actual yield in bushels of shelled grain per

acre and the relative yield are given for the dent and flint varieties grown for grain at Mt. Carmel. At Storrs, in addition to these data, figures were also obtained for the production of stover, the per cent of dry matter in the ear corn at harvest and the per cent of soft corn. As would be expected the yields of all varieties varied with the season. For example, the highest yield obtained at Mt. Carmel during the nine years of the test ranged from 59 bushels in 1920 to 114 bushels in 1917. Since the varieties were not all grown in the same years the only way to compare them fairly with each other is to calculate their yield relative to the yield of some one variety grown every year. This has been done, using Burwell's Yellow Flint as the standard of comparison because it ripened every year and was well adapted to the conditions at both places. It was used as the check for the flint varieties at Storrs and Mt. Carmel and its yield is based on an average of a large number of plots. The relative figures given in the tables are the percentage ratings based on Burwell as 100. In the case of yield, for example, the relative yield is obtained by dividing the actual yield of each variety by the yield of Burwell for that year with the result stated as percent. The relative yield for each year is then averaged to give the final relative yield given in the tables. A relative yield above 100 indicates to what extent the variety surpassed Burwell's Yellow Flint in yield of grain while a result below 100 indicates a correspondingly inferior yield.

The number of days which a variety requires to mature can not be determined with any great degree of accuracy. The method used was to go thru the field at stated intervals during the ripening period and note all varieties that were ready to be cut and put in the shock. This was determined when most of the ears were well glazed, the lower leaves drying and the husks turning yellow. Usually one observer took the notes on maturity for all the varieties so that the results are comparative. Since the time of maturity varied with the seasons it is necessary to state maturity relative to some one variety as in the case of yield. The relative times to mature for each variety for each of the years it was grown have been calculated and averaged. Based on these averages all varieties have been classified as early, medium, late or very late according to an arbitrary number of days. This scale was determined by classifying all the varieties in fairly even sized groups. The scale is the same for both dent and flint varieties grown for grain at both Storrs and Mt. Carmel. A different scale was used for the silage varieties. No great accuracy is claimed for this method of classification but it is thought the results would be more useful stated in this way rather than in actual number of days required to mature. All varieties that matured in approximately 117 days or less are classed as early, those between 118 and 126 as medium, between 127 and 135 as late and all that required more than 136 days as very late. Since

the corn was planted about the twentieth of May each year this means that the early varieties were mature about September fifteenth on the average. The medium varieties matured around the twenty-fifth, the late varieties about the first week in October. Any varieties maturing later than that or which did not mature before frost are classed as very late. These are average results. In some seasons all varieties required a longer period of time to ripen than they did in other seasons.

On account of the variability of the fields on which these tests were conducted and the great fluctuation from season to season it is extremely difficult to get reliable results upon which to base a comparison of varieties. Although the use of check plots tends to correct for soil differences and calculating the yields relative to a

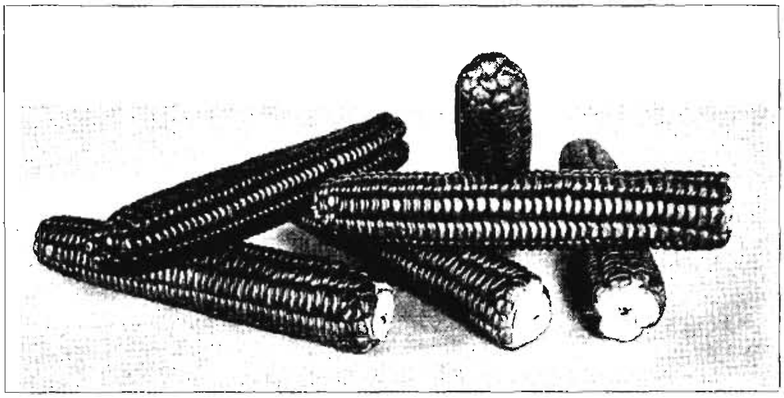

Figure 28.
An early type of flint corn.

single variety tends to offset seasonal variation it is certain that varieties react differently in different situations and in different seasons. Variation in the stand of plants and plot competition all enter as factors to make the results erratic. Another serious problem in variety tests is the rate of planting. Mooers at the Tennessee Station and others have shown that there is an optimum rate of planting for each variety and that this varies with the productivity of the soil and season. In general mall growing varieties give their best yields when planted thick while larger varieties must be planted more thinly to give their best results. In a test of a large number of varieties it has been impossible to plant the varieties at different rates. The rate used, three plants to a hill spaced three feet apart each way, had been shown to give the best results for many of the varieties grown in Connecticut and so was used. But it seems apparent that many of the

larger varieties were handicapped at this rate of planting. For all of these reasons small differences in yield do not necessarily indicate any real differences in yielding ability, particularly in varieties that have been tested less than three years.

Productiveness of Flint Varieties at Mt. Carmel and Storrs.

Many varieties which give the highest yields at Mt. Carmel are also good producers at Storrs in spite of the fact that the differences in soil and season tend to make varieties behave differently in the two places. For this reason the tests show real differences in yielding capacity. In all, 62 varieties of flint corn were grown at Mt. Carmel. Of these 38 were grown three years or more. At Storrs 72 flint varieties were grown and of these 44 were tested three years or more. In the list of the 20 highest yielding flint varieties at Mt. Carmel, tested for three years or more there are 15 which are also in the list of 20 highest yielding flint varieties at Storrs. Therefore three out of four are among the highest yielders in both places, whereas by pure chance alone less than one out of four would be found on both lists.

Highest Yielding Flint Varieties.

Those varieties that are among the highest yielders at both places are given in italics. All varieties are listed alphabetically and not in order of their productiveness:

GROWN AT MT. CARMEL	GROWN AT STORRS
Avery's White Flint	*Bacon's Gold Nugget*
Bacon's Gold Nugget	*Behan's Longfellow*
Behan's Longfellow	*Bissell's Yellow Dutton*
Bissell's Yellow Dutton	*Burwell's Yellow Flint*
Burwell's Yellow Flint	Chace's Yellow Flint
Frost's Yellow Flint	*Frost's Yellow Flint*
Gelston's Longfellow	Griswold's Canada Yellow
Ibsen's Yellow Flint	Hauschild's Yellow Flint
Keeler's Longfellow	Healy's Yellow Flint
Mammoth White Flint	*Keeler's Longfellow*
McLean's Flint	*Mammoth White Flint*
Mosher's Longfellow	*Mosher's Longfellow*
Pied Flint	*Pied Flint*
Purdy's Gold Nugget	*Purdy's Gold Nugget*
R. I. Exp. Station's R. I. White Flint	*R. I. Exp. Station's R. I. White Flint*
Sanford White Flint	*Sanford White Flint*
Skilton's Smut Nose Flint	*Skilton's Yellow Flint*
Skilton's Yellow Flint	Stickney's Yellow Flint
U. S. Dept. Agric. No. 193	*U. S. Dept. Agric. No. 193*
Zwick's Yellow Flint	*Zwick's Yellow Flint*

Productiveness of Dent Varieties at Mt. Carmel and at Storrs.

In all, 70 varieties of dent corn were grown at Mt. Carmel and 69 at Storrs. Of these 36 and 37 respectively were tested three years or more. Of the 20 highest yielding dent varieties at Mt.

Carmel 14 are also among the 20 highest at Storrs. Here again nearly three out of four of the high yielders are the same varieties in both places where the chances, if all varieties were potentially equal, would be about one in four. Among six high yielding varieties at Mt. Carmel that are not in the high yielding list at Storrs there are four that were late varieties from the southern part of the state or farther south that did not ripen well at Storrs. On the other hand four of the six high yielders at Storrs not represented at Mt. Carmel are medium or early varieties from the central or northern part of the state and for that reason might not be expected to yield well at Mt. Carmel.

Highest Yielding Dent Varieties

Those varieties that are among the highest at both places are given in italics. All varieties are listed alphabetically and not in order of their productiveness.

GROWN AT MT. CARMEL	GROWN AT STORRS
Beardsley's Leaming	*Beardsley's Leaming*
Brewer's Dent	*Century Dent*
Century Dent	*Dowd Dent*
Connecticut Dent	*Early Michigan*
Cornell No. 11	Hamilton's Leaming
Dowd Dent	*Herr's White Cap*
Early Michigan	Hickory King
Funk's 90 Day	Johnson's Yellow Dent
Herr's White Cap	*Lakeside Dent*
Klondyke	*Lanterman's Leaming*
Lakeside Dent	*Luce's Favorite*
Lanterman's Leaming	*Northern White Dent*
Luce's Favorite	Peck's Yellow Dent
Minnesota White Cap	Prince's Leaming
Northern White Dent	Sharon White Cap
Silver King	*Silver King*
Sutton's Dent	*Sutton's Dent*
Tryon Dent	*Tryon Dent*
Vinehill Leaming	*Vinehill Leaming*
Webber's Dent	*Webber's Dent*

The high yielding varieties of both dents and flints were somewhat later in maturing on the average than the general run of varieties. There were no early dents in the list of 20 highest either at Storrs or Mt. Carmel. Among the 20 flints there were five early varieties at Storrs and three at Mt. Carmel. Most of the high yielding varieties were medium in time of ripening. The correlation between number of days to mature and yield is rather high when the dents and flints are considered together, the co-efficient of correlation being $+.580 \pm .035$ for the Storrs data. For the flints alone the correlation co-efficient is $+.416 \pm .039$ and for the dents alone, $-.039 \pm .050$. The lack of correlation in the latter case is due to the fact that many late varieties did not mature properly and yielded poorly for that reason. The high correlation for the dents and flints together is due to the fact that the dents as a class ripen later than the flints and yield correspondingly more.

QUALITY OF HUSKED CORN.

With regard to quality of husked corn the high yielding varieties are surpassed by some early ripening sorts as might be expected. Data were obtained at Storrs on the amount of moisture in the ear corn at husking and the proportion of soft corn, which includes all corn that is immature, moldy and otherwise unfit to crib well. These figures for the dents and flints calculated on the percentage basis relative to Burwell are given in the accompanying table.

COMPARISON OF THE HIGHEST YIELDING DENTS AND FLINTS WITH ALL VARIETIES IN RELATIVE AMOUNT OF DRY MATTER AND SOFT CORN.

	Relative per cent dry matter in ear corn.	Relative amount of soft corn
Average of 20 highest yielding dent varieties	90	820
Average of all dent varieties	92	579
Average of 20 highest yielding flint varieties	98	299
Average of all flint varieties	100	174

In general, therefore, it is apparent that a high yielding variety will be obtained with some sacrifice in quality of corn and with some risk as to maturity. None of the high yielding dents are in the class of early varieties. On the other hand some of the highest yielding varieties are below the average in the proportion of soft corn. In the amount of stover produced the twenty highest dents and flints at Storrs, where the data were taken, are above the average as would be expected, as a vigorous growth with large stalks and leaf surfaces is necessary to make large yields.

VARIETIES FOR SILAGE.

Since many varieties of corn are grown for silage which do not mature properly for husking a separate test of corn for silage has been made at both Storrs and Mt. Carmel. The method of planting the varieties with the use of check and guard rows has been the same as with the other varieties. Enough seed was used to insure as nearly perfect a stand of plants as possible and the excess seedlings thinned out as soon as large enough to be pulled. As explained before, the entire stalks from each plot were weighed in the field as soon as cut and a sample taken to determine the amount of moisture in the corn as it would go into the silo. Yields are based on the total amount of dry matter produced.

Seventy-eight varieties were tested for silage purposes at Storrs of which 26 were grown three years or more. Of the total number 6 varieties were flints. The others were dents with the exception of a few varieties like Hickory King and Luce's Favorite which are intermediate in type. At Mt. Carmel 46 varieties were tested, 21 being grown three years or more. Five varieties of flints were included.

Highest Yielding Silage Varieties.

Those varieties that are among the highest at both places are given in italics. All varieties are listed alphabetically and not in order of their productiveness.

GROWN AT MT. CARMEL	GROWN AT STORRS
Beardsley's Leaming	*Beardsley's Leaming*
Brewer's Dent	Dowd Dent
Eureka	Early Michigan
Funk's 90 Day	*Eureka*
Gelston's Ensilage	*Funk's 90 Day*
Griswold's White Cap	Hickory King
Klondyke	*Klondyke*
Lakeside	*Lakeside*
Luce's Favorite	Leaming (W. H. Strong)
Mastodon	*Mastodon*
Northern White Dent	*Northern White Dent*
Webber's Dent	Sutton's Dent

The accompanying list of 12 highest yielding varieties at Storrs and Mt. Carmel is based on the percentage rating giving the yield in dry matter per acre relative to the yield of Eureka stated as 100 per cent. If we consider only the highest yielding six varieties at both places, which is roughly one-fourth of the number of varieties grown three years or more, we find that four varieties are included on both lists. Since the expectancy on the basis of random distribution is less than one in sixteen because not all varieties were grown at both places it is apparent that the test has brought out actual differences in yielding capacity.

At both Storrs and Mt. Carmel, Eureka has given the highest average yield of dry matter per acre of all varieties, with Mastodon second. These late maturing southern grown varieties make a large vegetative growth but seldom go beyond the milk stage at Storrs. At New Haven the grain frequently reaches the soft dough stage and in some years many of the ears are glazed. However, the proportion of grain is always low even under the best conditions. The leaves also frequently die and fall off the lower half of the stalks due to the dense shading so that the silage is largely made up of stalks. As the corn goes into the silo the per cent of dry matter is lower than the average of all varieties tested as follows:

	Per cent Dry Matter. Storrs	Mt. Carmel
Eureka	20	27
Mastodon	20	29
Average of all varieties	26	31

It is therefore apparent that these late varieties make silage that is bulky but low in actual food value. Eureka silage is higher in water and crude fiber and lower in protein, sugar, starch and fat than earlier maturing varieties. However, the greater production of dry matter per acre tends to make up for this but the amount of some of the ingredients per acre produced by Eureka

and Mastodon is still below the production of varieties that regularly reach the dough stage as shown by the data at Storrs.

PRODUCTION IN POUNDS PER ACRE OF THE PRINCIPAL INGREDIENTS OF SILAGE FROM DIFFERENT VARIETIES.

	Ash	Crude Protein	Crude Fiber	Nitrogen Free Extract	Fat	Total Dry Matter
Eureka	361	490	2455	5244	108	8658
Mastodon	372	569	2087	5087	132	8247
Leaming	307	623	1792	5244	195	8161
Pride of the North	246	505	1326	4353	169	6599

As producers of starch and sugar (nitrogen free extract) and mineral matter (ash) the very late varieties are equal to any varieties but are deficient per unit of area in protein and fat.

There is also the question of comparative palatability and digestibility of the silage which obviously cannot be answered save by feeding the silage and noting the result. This has been done at the Storrs Station and the results have been reported by Slate, White and others. The experiment was carried out by growing three different types of corn—early, medium and late—and feeding the silage of these varieties separately to three different lots of milk cows. The varieties chosen were: Pride of the North, as a variety which regularly reaches the hard dough stage at Storrs; Leaming, from seed grown in Ohio which reaches the soft dough stage and makes a large stalk growth; and Eureka, a southern white variety from seed grown in Virginia, which seldom has time to grow beyond the blister or milk stage. All animals were fed the same amount of silage supplemented with hay. The amount of grain fed was varied to maintain constant weight. The results are summarized by the authors as follows:*

1. "Silage from the Early Maturing (Pride of the North) corn has a superior feeding value for milk production to the Late Maturing (Eureka), while the Medium Maturing (Leaming) lies intermediate. The dry matter content of the Leaming is almost exactly halfway between the other two and likewise the feeding value proved to be about halfway between. This is clear when it is stated that with Early silage 28.57 pounds of grain was required to produce each hundred of milk, being 9.74 pounds less than for Late and 4.76 less than for Medium."

2. "Due to the larger acre yields of Late and Medium, they will produce more food and hence more milk per acre than the Early maturing corn. The Late has the advantage in this respect, although to procure 500 pounds more of milk it was necessary to handle four tons more of silage in and out of the silo. On land where Early will yield 69 per cent. and where Medium will yield 85.6 per cent. as much as Late, they are on even terms in production value. Our yields of Early and Medium were 60 per cent.

*Storrs Agric. Exper. Station Bull. 121, 1924.

and 80 per cent. respectively of the tonnage of Late. About 1.2 acres of Early and 1.1 acres of Medium were, therefore, required to equal one acre of Late in feeding value."

3. "These results justify the use of the Late maturing, high yielding varieties of corn on the intensive dairy farms of northern and northeastern United States. However, where saving of other feeds is primary, the Medium corn of good yielding capacity, which reaches the dough stage before harvesting is nearly equal to the Late in acre milk production value, and ton for ton it will produce milk at a 13 per cent. saving of other feeds. But the Early maturing varieties will generally lose out in intensive dairy sections because of their low yield, even though they are more valuable ton for ton."

4. "The solution of the problem will doubtless be found in this statement: On farms where the price of milk is low and it is desired to save as much grain as possible, Medium should pay best; but on a farm where the available corn land is limited and the price of milk reasonably high, Late should pay best."

Comparison of Dent and Flint Corn.

Many things must be taken into consideration in comparing dent with flint varieties of corn with regard to their suitability for grain and fodder production. The principal points to be considered are maturity, yield, quality of grain, character of fodder and germination of the seed. Both tests at Storrs and Mt. Carmel show that the flint on the average matures earlier than the dent corn. There is a difference of seven per cent. in favor of the flints at both places when maturity is given a percentage rating relative to the maturity of one variety grown throughout the test. On the other hand the dents yield more as might be expected since they have a longer growing season. At Storrs all of the dents average 58 bushels, the flints 55 bushels. At Mt. Carmel the yields were 62 to 59 in favor of the dents. To answer the question as to whether or not there is any difference in the relative efficiency of the two types, that is, the rate production in a given time, medium ripening dents are compared with flints which had the same length of growing season. Only varieties grown three years or more are used. Twenty-two flints averaged 55.4 and 23 dents averaged 59.8 bushels at Storrs. This is a difference of 7.9 per cent. in favor of the dents. At Mt. Carmel comparing varieties of the same growing season, 33 flints averaged 59.1 and 20 dents averaged 65.3 bushels. This is a difference of 10.5 per cent. in favor of the dents. Taking all varieties and dividing the relative yield by the relative number of days to mature we get 0.990 and 0.924 per cent. for dents and flints respectively at Storrs and 0.971 and 0.940 at Mt. Carmel. These figures are the average production per day relative to the standard variety with which they are all compared. It is thus

seen that on the basis of production per day the dents are somewhat more efficient than flints.

To offset this advantage the flints are more certain producers and over a period of years will ripen their crop more consistently than will the dents. In unfavorable seasons the highest flints will outyield the highest yielding dents. Moreover, all but the very late varieties of flint corn will practically always ripen sufficiently to crib well whereas many of the later dent varieties occasionally will not ripen satisfactorily. Flint corn has less soft corn and consequently has somewhat greater feeding value. Also flint corn seed will often germinate better unless special precautions are taken to store dent corn so that it will dry thoroughly before freezing weather.

Figure 29.
Upland situations usually escape the first fall frosts and consequently can mature later varieties.

The large kernels and hard texture of flint corn are objectionable for some purposes and the larger number of ears per plant and the stronger shanks make the labor cost of harvesting flint corn greater. Flint corn produces more stalks from the same amount of seed and the stalks are more slender. Consequently flint corn fodder is more preferred than dent, more of it is eaten and the refuse stalks are less difficult to handle in the manure.

Comparison of Yellow and White Corn.

Investigations conducted at the Wisconsin Station and elsewhere show that yellow corn has a slightly greater feeding value than white corn, due to a higher vitamine content. This is shown most clearly by pigs which do not have access to green pasture. Cattle and horses fed clover, alfalfa hay or silage show no difference in

the feeding value of yellow or white corn. These experiments have been conducted with western dent corn. It is not established that white flint corn is less valuable than yellow flint corn for feeding purposes. Since both colors in flint corn are about equally common there seems to be no popular prejudice against white flint corn. In contrast to this very few purely white varieties of dent corn are grown in New England. In productiveness yellow and white corn are equal. At Mt. Carmel 58 yellow dent varieties averaged 105.9 and six white dent varieties average 106.8 per cent. relative yield. Forty-seven yellow flints altogether gave a yield

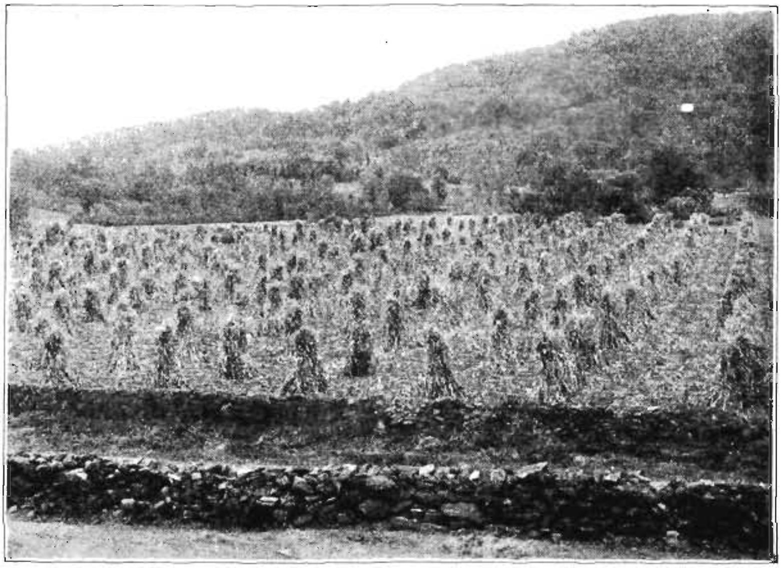

Figure 30.
In the valleys corn must mature before the first fall frosts.

of 91.4 and 15 white flints 91.8 per cent. These differences are too small to be significant.

Recommended Varieties.

Varieties which yield well in the southern part of the state will not ripen in the more northern parts at higher altitudes. On the other hand early varieties which ripen in the short season localities do not yield as well as later varieties where the season is longer. Also varieties differ in their adaptability to different soils and crop rotations. An attempt has been made in the accompanying map to divide the state arbitrarily into five districts and to compile a

list of varieties which will most likely do well in their respective districts. The districts are numbered in order of the length of growing season, number one in general requiring the earliest maturing varieties and five the latest. Since the varieties were tested in only two of these districts their behavior in the other districts cannot be stated except as they have already been grown there. Moreover corn which is taken from one district and tested in another may not show its value for its own district. But since there are a number of varieties from other districts that yielded well in both districts I and V it is thought that they will do well in other places where they are not now commonly grown.

For these reasons it should be clearly understood that the lists of recommended varieties are suggestive only. All new varieties should be carefully tried in the locality where they are to be grown. Many trials of this kind have been conducted by the Farm Bureaus in the various districts and much information is already available as to suitable varieties.

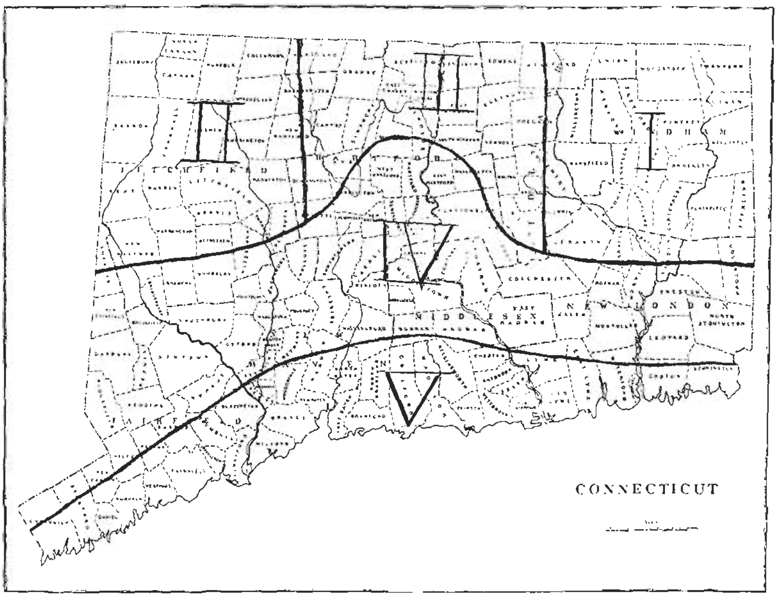

Figure 31.

Connecticut divided into five arbitrary corn growing districts according to the length of growing season.

The following high yielding varieties and strains seem to be well adapted for the districts indicated and shown on the map. It must be borne in mind that these sections cannot take into consideration all differences in soil, altitude and climate. The varieties listed for each district cannot all be grown successfully in all parts of the district. Some of the varieties have not been grown in the district for which they are recommended so that their adaptation to that district is not proven. The varieties are listed approximately in order of their earliness.

District I.

GRAIN.

Flints.

Rhode Island White Cap	R. I. Exp. Station, Kingston, R. I.
Canada Yellow Flint	Griswold & Sons, So. Wethersfield
Skilton's Yellow Flint	Julius Skilton, Watertown
Burwell's Yellow Flint	E. E. Burwell, New Haven
Healey's Yellow Flint	L. H. Healey, Woodstock
Stickney's Yellow Flint	L. J. Grant, Wapping
Zwick's Yellow Flint	Louis Zwick, Plantsville

Dents.

Pride of the North	Conn. Agricultural College, Storrs
Sharon White Cap	E. K. Dean, Sharon
Century Dent	S. M. Waldron, New Milford
Herr's White Cap	W. F. Herr, Brooklyn
Early Michigan	G. A. Erskine, Guilford
Leaming	H. Hamilton, Ellington
Vinehill Leaming	Vinehill Farm, Elmwood
Peck's Yellow Dent	W. O. Peck, East Haddam

SILAGE.

Lakeside	N. Jones, South Windsor
Leaming	H. Beardsley, Roxbury
Early Michigan	G. A. Erskine, Guilford
Northern White Dent	B. W. Bishop, Guilford

District II.

GRAIN.

Flints.

Frost's Yellow Flint	Charles Frost, Sherman
Burwell's Yellow Flint	E. E. Burwell, New Haven
Skilton's Yellow Flint	Julius Skilton, Watertown
Yellow Dutton	C. H. Bissell, Lakeville
Gold Nugget	Mary Bacon, Kent
Sanford White Flint	Jesse St. John, Kent
Gelston's Longfellow	N. G. Gelston, Sherman
Mosher's Longfellow	N. R. Mosher, Sherman

Dents.

Sharon White Cap	E. K. Dean, Sharon
Century Dent	S. M. Waldron, New Milford
Webber's Dent	Willis Frost, Bridgewater
Beardsley's Leaming	H. Beardsley, Roxbury

SILAGE.

Same as District I.

District III

GRAIN.

Flints.

King Philip............................W. E. Price, Warehouse Point
Hill's Red Flint................................S. F. Brown, Windsor
McLean's Flint............................J. B. McLean, Simsbury
Stickney's Yellow Flint..........................L. J. Grant, Wapping
Healey's Yellow Flint.......................L. H. Healey, Woodstock

Dents.

Hasting's Yellow Dent.........................W. S. Hastings, Somers
Early Lakeside.................................N. Jones, So. Windsor
Pride of the North................Storrs Agricultural Experiment Station
Century Dent...........................S. M. Waldron, New Milford
Leaming.......................................H. Hamilton, Ellington
Herr's White Cap................................W. F. Herr, Brooklyn

SILAGE.

Same as District I.

District IV.

GRAIN.

Flints.

Skilton's Yellow Flint.......................Julius Skilton, Watertown
Zwick's Yellow Flint..........................Louis Zwick, Plantsville
Burwell's Yellow Flint......................E. E. Burwell, New Haven
Frost's Yellow Flint............................Charles Frost, Sherman
Longfellow......................................R. Keeler, Bridgewater
Longfellow.......................................P. J. Behan, Roxbury
Sanford White Flint.............................Jesse St. John, Kent
Gold Nugget.......................................Mary Bacon, Kent
U. S. Dept. Agriculture No. 193....Bureau Plant Industry, Washington, D. C.

Dents.

Century Dent...........................S. M. Waldron, New Milford
Early Lakeside.................................N. Jones, So. Windsor
Beardsley's Leaming...........................H. Beardsley, Roxbury
Webber's Dent...............................Willis Frost, Bridgewater
Cornell No. 11.......................College of Agriculture, Ithaca, N. Y.
Brewer's Dent...............................N. H. Brewer, Hockanum
Vinehill Leaming............................Vinehill Farm, Elmwood
Hazenhurst White Cap...........................E. Hazen, Haddam
Early Michigan...............................G. A. Erskine, Guilford
Leaming.................................W. A. Lanterman, Fairfield
Herr's White Cap................................W. F. Herr, Brooklyn

SILAGE.

Beardsley's Leaming...........................H. Beardsley, Roxbury
Hazenhurst White Cap...........................E. Hazen, Haddam
Brewer's Dent...............................N. H. Brewer, Hockanum
Webber's Dent...............................Willis Frost, Bridgewater
Northern White Dent...........................B. W. Bishop, Guilford
Luce's Favorite.................Suffolk Co-op. Assoc., Mattituck, L. I.
Leaming.....................................F. S. Prince, Xenia, Ohio
Funk's 90 Day..................Funk Bros. Seed Co., Bloomington, Ill.

District V.

GRAIN.

Flints.

Burwell's Yellow Flint	E. E. Burwell, New Haven
Longfellow	R. Keeler, Bridgewater
Longfellow	P. J. Behan, Roxbury
Sanford White Flint	Jesse St. John, Kent
Frost's Yellow Flint	Charles Frost, Sherman
Gold Nugget	Mary Bacon, Kent
Gold Nugget	A. L. Purdy, Port Chester, N. Y.
U. S. Dept. Agriculture No. 193	Bureau Plant Industry, Washington, D. C.

Dents.

Century	S. M. Waldron, New Milford
Lakeside Dent	N. Jones, So. Windsor
Beardsley's Leaming	H. Beardsley, Roxbury
Webber's Dent	Willis Frost, Bridgewater
Early Michigan	G. A. Erskine, Guilford
Herr's White Cap	W. F. Herr, Brooklyn
Brewer's Dent	N. H. Brewer, Hockanum
Lanterman's Leaming	W. A. Lanterman, Fairfield
Northern White Dent	B. W. Bishop, Guilford
Luce's Favorite	Suffolk Co-op. Assoc., Mattituck, L. I.
Sutton's Dent	R. C. Wilcox Sons, Guilford
Vinehill Leaming	Vinehill Farm, Elmwood

SILAGE.

Northern White Dent	B. W. Bishop, Guilford
Leaming	S. F. Prince, Xenia, Ohio
Funk's 90 Day	Funk Bros. Seed Co., Bloomington, Ill.
Early Mastodon	E. G. Packard, Dover, Del.
Eureka	Ross Bros. Seed Co., Worcester, Mass.

Changing Seed.

Some of the high yielding varieties as shown in these tests, are now no longer grown by the farmers from whom they were secured. In a few cases these varieties cannot be located anywhere and it is probable that they have been lost. From this it is seen that the practice of changing seed is quite common in Connecticut. These tests show clearly that it is not necessary to secure new varieties from another part of the state or from without to maintain high yields. Many of the very best varieties have been grown continuously on the same farm for as long as there is any record and there is no reason why they should not go on giving satisfaction.

The more than one hundred and fifty varieties and strains of corn grown in Connecticut is in marked contrast to the central corn growing districts where a single variety is grown almost exclusively over wide areas. New varieties should not replace well established varieties until their superiority has been demonstrated on the farm where the corn is to be grown.

Summary.

Nearly 150 different varieties and strains of flint and dent corn have been grown at Mt. Carmel and at Storrs to compare their yield of grain and time of ripening. These varieties are described and a history of their origin is given as far as known.

Certain varieties have yielded among the highest at both places. These are listed on pages 401, 402 and 404.

Dent varieties on the average require a longer growing season than flints and yield more grain and stover.

When dent and flint varieties maturing in the same length of time are compared the dents on the average yield 7.9 per cent. more at Storrs and 10.5 per cent. more at Mt. Carmel than the flints showing that they are somewhat more efficient as producers of grain, but the dents do not always ripen as satisfactorily as the flints.

In some seasons the highest yielding flint varieties surpass the highest yielding dent varieties at both places tested.

There is no difference in the yield of yellow and white dent varieties or of flint varieties.

The state is divided into five districts, and dent, flint and silage varieties recommended for trial in each district are listed on pages 409 to 411.

Reference to Literature Cited.

1. Carrier, Lyman. A Reason for the contradictory results in corn experiments. Jour. American Soc. of Agronomy, 1919, vol. 11, pp. 106–113.
2. Hayden, C. C. & Perkins, A. E. Field corn and silage corn for silage. Ohio Agric. Exp. Station Bull. 369, 1923.
3. Kiesselbach, T. A. Experimental error in field trials. Jour. Amer. Soc. of Agronomy, 1919, vol 11, pp. 235–247. Corn investigations, Nebraska Agric. Exp. Station Research Bull. 20, 1922.
4. Mooers, C. A. Varieties of corn and their adaptability to different soils. Tennessee Agric. Exp. Station Bull. 126, 1922.
5. Slate, W. L., Brown, B. A., White, G. C., and Chapman, L. M. A comparison of early, medium and late maturing varieties of silage corn for milk production. Jour. of Dairy Science, 1922, vol. 4, pp. 333–347 and 1923, vol. 6, pp. 382–392, and Storrs Agr. Exp Station, Bul. 121, 1924.
6. Steenbock, H. and Bantwell, P. W. Fat-soluble vitamine III. The comparative nutritive value of white and yellow maizes. Jour. Biol. Chemistry, 1920, vol. 41, pp. 81–96.

TABLE I. FLINT VARIETIES GROWN AT MT. CARMEL.

Variety	Source of seed.	No. years tested.	Color.	Maturity.	Actual yield, bu. per acre.	Relative yield, per cent.
Argentine Flint	S. D. LaBarr, Greenwich	2	Yellow	Medium	66.1	90.4
Averill's Yellow Flint	Albert Averill, Pomfret Landing	1	Yellow	Medium	56.5	81.2
Avery's White Flint	B. T. Avery, Ledyard	3	White	Medium	65.5	94.6
Beebe's Yellow Flint	C. M. Beebe, Uncasville	1	Yellow	Early	65.5	82.2
Borger's Yellow Flint	C. E. Borger, New Preston	4	Yellow	Early	46.6	80.1
Brewer's Flint	N. H. Brewer, Hockanum	1	Yellow	Medium	59.0	84.8
Burwell's Flint	E. E. Burwell, New Haven	8	Yellow	Medium	61.4	100.0
Canada Yellow Flint	Thomas Griswold & Sons, South Wethersfield	3	Yellow	Medium	63.5	89.1
Canada Yellow Flint	Jason Lathrop, Plainfield	6	Yellow	Medium	50.8	76.6
Canada Yellow Flint	L. S. Abbe, Hazardville	1	Yellow	Early	45.4	73.9
Chace's Yellow Flint	M. W. Chace, Pomfret Landing	4	Yellow	Medium	62.3	88.3
Connecticut Yellow Flint	O. S. Olmsted, Hazardville	3	Yellow	Early	59.0	84.8
Crowell's Prolific	David Crowell, Middletown	1	Yellow	Late	58.0	83.3
Davis' Yellow Flint	P. E. Davis, Granby, Mass.	3	Yellow	Early	64.6	90.1
Double Capped White Flint	W. A. Thrall, Windsor	1	White	Medium	44.2	93.1
Fairview Flint	Harrison Hamilton, Ellington	3	Yellow	Early	55.3	79.6
Fenn's 12 Row	R. M. Fenn, Middlebury	4	Yellow	Medium	48.0	92.8
Frost's Yellow Flint	Charles Frost, Sherman	5	Yellow	Medium	66.3	120.4
Gold Nugget	Mary Bacon, Kent	6	Yellow	Medium	73.1	116.5
Gold Nugget	A. L. Purdy, Port Chester, New York	4	Yellow	Medium	55.6	106.7
Gold Nugget	J. B. Stratton, Watertown	2	Yellow	Medium	60.6	113.1
Griswold's 90 Day	Thomas Griswold & Sons, South Wethersfield	3	Yellow	Early	50.3	68.0
Hauschild's Yellow Flint	Julius Hauschild, Storrs	1	Yellow	Early	68.1	85.4
Ibsen's Yellow Flint	J. C. Ibsen, North Haven	3	Yellow	Medium	54.5	100.5
King Philip	W. E. Price, Warehouse Point	7	Red	Medium	54.3	84.6
Longfellow	John Basham, Middlebury	4	Yellow	Early	49.0	83.8

Longfellow	P. J. Behan, Roxbury	5	Yellow	Medium	56.1	100.0
Longfellow	N. G. Gelston, Sherman	4	Yellow	Early	63.9	93.2
Longfellow	Reuben Keeler, Bridgewater	4	Yellow	Medium	59.9	101.9
Longfellow	N. R. Mosher, Sherman	3	Yellow	Early	67.6	95.3
Mammoth White Flint	O. S. Olmsted, Hazardville	4	White	Late	83.4	118.6
Mammoth Yellow Flint	Louis Rosensweig, South Canterbury	1	Yellow	Late	71.4	102.6
McLean's Flint	J. B. McLean, Simsbury	3	Yellow	Early	50.7	94.4
Montgomery's White Flint	Phelps Montgomery, Mt. Carmel	1	White	Medium	55.6	84.1
Pied Flint	Reuben Keeler, Bridgewater	3	Yellow and White	Medium	73.0	102.7
Red Flint	Benj. Neleber, Colchester	2	Red	Medium	62.1	85.2
Red Flint	Albert Hale, South Glastonbury	1	Red	Medium	63.2	90.8
Red Flint	S. F. Brown, Windsor	4	Red	Early	61.0	86.5
Rhode Island Premium	W. J. Clark, Woodbury	3	Red	Early	54.5	77.3
Rhode Island White Flint	E. P. Barnes, Norwich	2	White	Medium	75.9	104.4
Rhode Island White Flint	A. C. Botham, Pomfret	2	White	Early	62.2	84.8
Rhode Island White Flint	W. P. Briggs, Lebanon	3	White	Early	57.6	81.3
Rhode Island White Flint	F. W. Newton, South Canterbury	2	White	Medium	55.3	81.5
Rhode Island White Flint	Rhode Island Experiment Station, Kingston, R. I	6	White	Medium	60.9	93.7
Rhode Island White Flint	A. A. Young, Jewett City	2	White	Medium	72.0	98.7
Root's Yellow Flint	L. C. Root, Farmington	1	Yellow	Medium	39.4	82.9
Sanford White Flint	C. E. Hough, Washington	1	White	Medium	40.6	85.5
Sanford White Flint	Jesse St. John, Kent	7	White	Medium	64.0	106.6
Schultz's White Flint	W. F. Schultz, Saybrook	1	White	Medium	36.6	77.0
Sheffield Yellow Flint	C. H. Sage, East Canaan	4	Yellow	Early	56.9	82.9
Skilton's Yellow Flint	Julius Skilton, Watertown	6	Yellow	Medium	61.8	98.6
Smut Nose Flint	G. A. Skilton, Watertown	3	White	Medium	56.1	93.8
Smut Nose Flint	Robert Skilton, Morris	4	White	Early	54.7	79.4
Stickney's Yellow Flint	G. E. Stickney, Newburyport, Mass	2	Yellow	Medium	61.9	85.0
Stickney's Yellow Flint	L. J. Grant, Wapping	2	Yellow	Medium	52.1	103.4
Taylor's Yellow Flint	G. E. Taylor, Shelburne, Mass.	3	Yellow	Medium	61.9	86.2
Tucker's Yellow Flint	F. E. Tucker, Vernon	2	Yellow	Medium	60.7	84.8
U. S. Dept. of Agric. No. 193	Office of Cereal Investigations, Bureau of Plant Ind., Wash., D. C.	3	Yellow	Medium	51.8	106.9
Wheaton's 12 Row	E. M. Wheaton, Putnam	3	Yellow	Medium	43.5	89.3
Yellow Dutton	C. H. Bissell, Lakeville	5	Yellow	Early	65.0	100.3
Yellow Dutton	H. Johnson, Washington	1	Yellow	Medium	42.6	89.7
Zwick's Yellow Flint	Louis Zwick, Plantsville	5	Yellow	Medium	66.6	96.7

Table II Dent Varieties Grown at Mt. Carmel.

Variety.	Sources of seed.	No. years tested.	Color.	Maturity.	Actual yield, bu. per acre.	Relative yield, per cent.
Bahler's White Dent	Adolph Bahler, Ellington	4	White	Medium	55.8	97.3
Brewer's Dent	N. H. Brewer, Hockanum	7	Yellow	Late	73.7	114.5
Brewer's Dent	B. F. Page, Durham	1	Yellow	Late	64.3	104.7
Century Dent	S. M. Waldron, New Milford	7	Yellow	Medium	69.8	118.0
Clark's Early Wonder	Harris Seed Co., Coldwater, New York	1	Yellow	Medium	76.4	115.6
Connecticut Dent	C. L. Howes, Stamford	4	Yellow	Late	80.6	113.9
Cornell No. 11	Dept. of Plant Breeding, Cornell Univ., Ithaca, New York	3	Yellow	Medium	56.6	115.3
Cornell No. 12	Dept. of Plant Breeding, Cornell Univ., Ithaca, New York	3	Yellow	Medium	54.3	110.6
Dibble's Dent	Dibble Seed Co., Honeoye Falls, New York	2	Yellow	Medium	83.8	114.2
Dowd Dent	R. C. Wilcox Sons, Guilford	4	Yellow	Medium	82.9	119.6
Eureka	Ross Bros. Seed Co., Worcester, Mass.	1	White	Very late	36.3	52.2
Funk's 90 Day	Funk Bros. Seed Co., Bloomington, Ill	3	Yellow	Very late	82.2	114.5
Gelston's Ensilage	W. I. Gelston, East Haddam	1	Yellow	Very late	58.1	83.5
Golden Dent	P. H. Woodford, Avon	6	Yellow	Late	71.6	107.5
Golden Dent	Alex. Smith, Clintonville	2	Yellow	Early	61.6	94.5
Hastings' Yellow Dent	W. S. Hastings, Somers	2	Yellow	Early	39.8	76.0
Hazenhurst White Cap	E. Hazen, Haddam	3	Yellow	Late	53.9	109.2
Herr's Yellow Dent	W. F. Herr, Brooklyn	2	Yellow	Late	61.7	123.6
Hickory King	R. C. Wilcox Sons, Guilford	3	Yellow	Medium	53.2	98.4
Holcomb's Dent	R. Holcomb, East Granby	1	Yellow	Medium	66.3	100.3
Early Huron	Harris Seed Co., Coldwater, New York	3	Yellow	Medium	76.1	106.2
Early Huron	M. H. Williams, Sunderland, Mass.	3	Yellow	Medium	79.6	110.6
Johnson's Yellow Dent	J. W. Moss, West Cheshire	3	Yellow	Late	52.6	106.6
Klondyke	George Hale, Westport	4	Yellow	Late	88.1	128.0
Lakeside Dent	N. Jones, South Windsor	8	Yellow	Late	69.1	112.4
Lakeside Dent	S. H. Peckham, Woodstock	1	Yellow	Medium	39.3	82.7
Lancaster Sure Crop	Lancaster County, Penna.	1	Yellow	Very late	60.3	131.7
Leaming	H. Beardsley, Roxbury	7	Yellow	Medium	74.9	122.1
Leaming	L. P. Drake, Harwinton	2	Yellow	Medium	76.5	104.8

Leaming	**W. A. Lanterman, Fairfield**	3	Yellow	Late	60.4	122.4
Leaming	F. S. Prince, Xenia, Ohio	2	Yellow	Late	57.0	111.7
Leaming	N. S. Strong, North Plain	1	Yellow	Medium	50.7	106.7
Leaming	W. H. Strong, Avon	1	Yellow	Early	79.6	117.6
Leaming	Vinehill Farm, Elmwood	4	Yellow	Medium	60.1	116.4
Long Island Dent	C. E. Salmon, Brooklyn	1	Yellow	Medium	15.4	32.4
Long's Champion Dent	Whitehorse Farms, Paoli, Penna.	1	Yellow	Very late	110.6	138.8
Luce's Favorite	Suffolk Co-operative Assoc., Mattituck, N. Y	4	Yellow	Late	61.9	117.5
Mason's White Dent	W. W. Chappell, North Franklin	4	White	Medium	62.9	91.2
Early Michigan	G. A. Erskine, Guilford	3	Yellow	Late	65.3	120.1
Early Michigan	H. J. Larkham, Norwichtown	1	Yellow	Medium	46.6	98.1
Minnesota White Cap	C. S. Griswold, West Hartford	4	Yellow	Late	81.7	115.1
Minnesota No. 13	W. A. Stocking & Sons, Weatogue	3	Yellow	Early	44.4	75.7
Montgomery's White Dent	Phelps Montgomery, Mr. Carmel	1	White	Medium	88.2	133.4
Northern White Dent	B. W. Bishop, Guilford	5	White	Late	77.0	121.9
Peck's Yellow Dent	W. O. Peck, East Haddam	2	Yellow	Late	62.3	122.0
Pride of the North	A. G. Gulley, Storrs	6	Yellow	Medium	58.6	92.4
Pride of the North	I. N. Hollister, Glastonbury	1	Yellow	Very late	57.7	82.9
Pride of the North	L. W. Kirk, Hamden	1	Yellow	Late	46.7	98.3
Red Cob	F. S. Platt Seed Co., New Haven	1	Yellow	Very late	59.7	85.8
Reynolds' Dent	W. W. Reynolds, New Britain	1	Yellow	Late	32.8	69.0
Sciota	B. F. Page, Durham	2	Yellow	Early	65.2	100.9
Sharon White Cap	E. K. Dean, Sharon	6	Yellow	Medium	64.8	102.3
Silver King	Roy McDonald, Menomonie, Wisconsin	3	White	Medium	57.2	116.8
Sutton's Dent	R. C. Wilcox Sons, Guilford	3	Yellow	Late	63.6	117.0
Sweepstakes	S. L. Hollister, Washington	1	Yellow	Late	38.5	81.0
Sweepstakes	Alex. Smith & Sons, Clintonville	1	Yellow	Late	36.9	77.7
Tryon Dent	J. E. Daniels, Middletown	3	Yellow	Medium	81.8	113.7
U. S. Dept. of Agric. No. 133	Office of Cereal Investigations, Bureau of Plant Ind., Wash., D. C.	3	Yellow	Medium	44.8	91.2
U. S. Dept. of Agric. No. 125	Office of Cereal Investigations, Bureau of Plant Ind., Wash., D. C.	2	Yellow	Very late	65.3	131.1
U. S. Dept. of Agric. No. 119	Office of Cereal Investigations, Bureau of Plant Ind., Wash., D. C.	2	White	Very late	54.9	110.8
Webber's Dent	Dept. of Plant Breeding, Cornell Univ., Ithaca, N. Y	3	Yellow	Medium	46.3	93.9
Webber's Dent	Willis Frost, Bridgewater	6	Yellow	Medium	72.2	120.5
White Cap	G. D. Hall, Wallingford	5	Yellow	Medium	64.5	93.0
White Cap	W. F. Herr, Brooklyn	3	Yellow	Medium	63.7	129.4
White Cap	L. C. Root & Son, Farmington	2	Yellow	Late	62.9	126.1
White Cap	Henry Squires, New Milford	1	Yellow	Medium	73.1	110.6
White Cap	N. S. Strong, North Plain	2	White	Early	47.0	80.2
White Cap	Joseph Whathley, Kent	1	Yellow	Medium	46.8	76.2
Woodford's Dent	G. C. Woodford, Plainville	2	Yellow	Medium	53.5	99.9

TABLE III SILAGE VARIETIES GROWN AT MT. CARMEL.

Variety.	Source of seed.	No. years tested.	Color.	Maturity.	Per cent. dry matter.	Actual green matter tons per acre.	Relative green matter per cent.	Actual dry matter tons per acre.	Relative dry matter per cent.
Bahler's White Dent	Adolph Bahler, Ellington	3	White	Medium	35.4	9.9	41.6	3.1	50.3
Brewer's Dent	N. H. Brewer, Hockanum	7	Yellow	Late	32.9	14.8	63.1	4.6	74.5
Brewer's Dent	B. F. Page, Durham	1	Yellow	Late	39.3	9.1	40.4	3.6	54.9
Century Dent	S. M. Waldron, New Milford	5	Yellow	Medium	31.6	13.4	54.6	3.7	60.1
Connecticut Dent	C. L. Howes, *Stamford*	4	Yellow	Medium	26.6	15.9	62.3	4.2	65.9
Curtain's Yellow Dent	E. Curtain, East Windsor	1	Yellow	Medium	25.2	14.1	60.2	3.6	63.4
Dibble's Yellow Dent	Dibble Seed Co., Honeoye Falls, New York	2	Yellow	Early	25.4	15.8	62.0	3.9	62.8
Dowd Dent	R. C. Wilcox Sons, Guilford	3	Yellow	Medium	29.4	14.9	55.0	4.1	59.0
Eureka	Ross Bros. Seed Co., Worcester, Mass.	8	White	Very late	26.6	22.4	100.0	5.9	100.0
Funk's 90 Day	Funk Bros. Seed Co., Bloomington, Ill.	3	Yellow	Late	29.3	15.4	63.8	4.5	75.1
Gelston's Ensilage	W. I. Gelston, East Haddam	4	Yellow	Medium	27.5	17.1	67.2	4.7	74.3
Golden Dent	Alex Smith, Clintonville	1	Yellow	Medium	45.8	5.6	24.9	2.5	39.2
Golden Dent	P. H. Woodford, Avon	6	Yellow	Medium	29.7	14.7	60.8	4.1	65.9
Gold Nugget Flint	Mary Bacon, Kent	4	Yellow	Medium	29.9	14.4	55.6	4.3	63.2
Hazenhurst White Cap	E. Hazen, Haddam	1	Yellow	Medium	29.5	15.7	81.7	4.6	91.6
Klondyke	George Hale, Westport	4	Yellow	Late	31.8	17.7	68.3	5.2	78.6
Lakeside Dent	N. Jones, South Windsor	4	Yellow	Medium	36.3	14.2	67.3	5.1	84.4
Leaming	H. Beardsley, Roxbury	6	Yellow	Medium	32.1	14.8	63.4	4.5	72.9
Leaming	L. P. Drake, Harwinton	1	Yellow	Early	24.2	13.4	48.4	3.2	49.9
Leaming	H. Hamilton, Ellington	2	Yellow	Medium	36.9	9.5	46.5	3.5	61.0
Leaming	E. Harris, Middletown	1	Yellow	Early	22.2	15.6	66.7	3.5	61.9
Leaming	W. A. Lanterman, Fairfield	1	Yellow	Late	33.3	15.6	81.5	5.2	103.4
Leaming	F. S. Prince, Xenia, Ohio	2	Yellow	Very late	32.1	12.0	68.5	3.9	85.7
Leaming	W. H. Strong, Avon	3	Yellow	Early	28.0	15.5	61.6	4.3	67.5

Leaming	Vinehill Farm, Elmwood	2	Yellow	Medium	36.4	9.6	47.1	3.4	65.9
Longfellow Flint	Platt Seed Co., New Haven	1	Yellow	Early	23.6	17.0	72.6	4.0	71.4
Luce's Favorite	Suffolk Co-operative Association, Mattituck, N. Y.	3	Yellow	Medium	35.1	13.6	69.4	4.7	82.0
Mammoth White Flint	O. S. Olmsted, Hazardville	4	White	Medium	27.4	16.6	64.8	4.7	69.5
Mammoth Yellow Flint	Louis Rosensweig, South Canterbury	1	Yellow	Medium	25.1	17.4	74.3	4.4	77.8
Mason's White Dent	W. W. Chappell, North Franklin	2	White	Early	24.4	13.7	43.2	3.3	46.6
Mastodon	Platt Seed Co., New Haven	2	Yellow	Very late	27.7	21.9	77.4	6.0	85.4
Mastodon	E. G. Packard, Dover, Delaware	6	Yellow	Very late	29.1	17.2	84.3	4.9	90.0
Minnesota No. 13	W. A. Stocking, Weatogue	2	Yellow	Medium	38.6	10.4	40.1	3.9	54.9
Northern White Dent	B. W. Bishop, Guilford	5	White	Late	33.4	15.8	68.4	5.0	79.7
Pride of the North	A. G. Gulley, Storrs	1	Yellow	Early	26.2	16.9	66.7	4.0	66.6
Pride of the North	I. W. Hollister, Glastonbury	1	Yellow	Medium	27.5	13.2	56.4	3.6	64.7
Red Cob	Platt Seed Co., New Haven	1	White	Very late	27.9	17.0	72.6	4.7	84.4
Sanford White Flint	Jesse St. John, Kent	2	White	Early	28.4	13.7	52.2	3.8	53.2
Silver King	Roy McDonald, Menomonie, Wisconsin	2	White	Medium	40.7	10.6	56.9	4.2	78.2
Stickney's Yellow Flint	G. E. Stickney, Newburyport, Mass	2	Yellow	Early	24.2	12.4	48.0	3.5	47.4
Sutton's Yellow Dent	R. C. Wilcox Sons, Guilford	3	Yellow	Late	38.7	10.4	52.8	4.0	70.1
Sweepstakes	Clark Seed Co., Milford	2	Yellow	Late	32.2	11.9	66.3	3.9	83.7
Tryon Dent	J. E. Daniels, Middletown	1	Yellow	Early	24.6	15.2	64.9	3.7	66.6
Webber's Dent	Willis Frost, Bridgewater	5	Yellow	Medium	36.6	12.2	58.9	4.3	76.0
White Cap	C. S. Griswold, West Hartford	4	Yellow	Early	27.4	17.5	67.8	4.7	73.7
White Cap	G. D. Hall, Wallingford	2	Yellow	Early	27.0	14.7	57.7	3.9	62.9

TABLE IV FLINT VARIETIES GROWN AT STORRS.

Variety.	Source of seed.	No. years tested.	Color.	Maturity.	Yield of stover pounds per acre.	Relative yield of stover per cent.	Yield of grain bushel per acre.	Relative yield of grain per cent.	Relative dry matter in ear corn per cent.	Relative per cent. soft corn per cent.
Argentine Flint	S. D. LaBarr, Greenwich	2	Yellow	Medium	3,096	56	51.1	82	101	82
Averill's Yellow Flint	Albert Averill, Pomfret Landing	2	Yellow	Early	3,845	74	60.9	89	104	119
Avery's White Flint	B. T. Avery, Ledyard	3	White	Medium	4,524	87	42.7	77	99	54
Barnes' White Flint	F. A. Barnes, Preston City	1	White	Medium	8,059	108	61.5	89	....	95
Beebe's Yellow Flint	C. M. Beebe, Uncasville	1	Yellow	Early	6,119	82	61.5	89	....	6
Brewer's Flint	N. H. Brewer, Hockanum	2	Yellow	Early	3,662	73	57.7	84	104	94
Burwell's Flint	E. E. Burwell, New Haven	9	Yellow	Medium	4,780	100	58.3	100	100	100
Canada Yellow Flint	Thomas Griswold & Sons, So. Wethersfield	3	Yellow	Medium	5,584	97	62.8	98	97	83
Canada Yellow Flint	Jason Lathrop, Plainfield	8	Yellow	Early	3,187	63	51.4	84	106	126
Canada Yellow Flint	L. S. Abbe, Hazardville	2	Yellow	Early	2,036	49	35.6	74	102	9
Chace's Yellow Flint	M. W. Chace, Pomfret Landing	4	Yellow	Early	4,705	81	58.0	93	98	71
Connecticut Yellow Flint	O. S. Olmsted, Hazardville	3	Yellow	Early	3,190	62	45.6	86	102	145
Crowell's Prolific	David Crowell, Middletown	1	Yellow	Late	6,920	120	58.8	89	89	148
Davis Yellow Flint	P. E. Davis, Granby, Mass	4	Yellow	Early	3,757	69	60.7	92	104	104
Double Capped White Flint	W. A. Thrall, Windsor	2	White	Early	3,015	58	46.4	73	102	0
Fairview Flint	Harrison Hamilton, Ellington	4	Yellow	Early	2,902	53	43.9	77	111	30
Fenn's 12 Row	R. M. Fenn, Middlebury	3	Yellow	Medium	4,171	94	46.0	81	97	384
Frost's Yellow Flint	Charles Frost, Sherman	4	Yellow	Medium	5,003	111	59.8	106	102	132
Gold Nugget	Mary Bacon, Kent	7	Yellow	Medium	5,198	119	59.2	109	94	619
Gold Nugget	A. L. Purdy, Port Chester, New York	3	Yellow	Medium	5,256	116	54.4	95	93	411
Gold Nugget	J. B. Stratton, Watertown	2	Yellow	Medium	5,954	137	46.6	95	90	282
Griswold's 90 Day	Thomas Griswold & Sons, So. Wethersfield	3	Yellow	Early	3,981	71	52.1	82	106	65
Hathaway's Yellow Flint	Auburn, Maine	1	Yellow	Early	1,065	23	30.3	42	....	123
Hauschild's Yellow Flint	*Julius Hauschild, Storrs*	4	*Yellow*	*Early*	4,751	87	62.5	96	98	88
Hayes' Canada Flint	M. C. Hayes, Granby	1	Yellow	Medium	3,533	75	64.7	90	....	123

Red Flint	Reuben Keeler, Bridgewater	3	Yellow and White	Medium	5,539	99	57.8	95	96	646
Red Flint	Benj. Neleber, Colchester	3	Red	Medium	5,128	96	66.1	100	101	62
Red Flint	Albert Hale, So. Glastonbury	1	Red	Early	4,211	73	58.9	90	99	96
Red Flint	S. F. Brown, Windsor	6	Red	Early	3,545	70	54.5	90	99	120
Red Glaze	J. H. Wilson, Baltic	1	Smut nosed White	Early	7,207	97	61.6	89	....	80
Rhode Island Premium	W. J. Clark, Woodbury	3	Red	Early	2,923	52	52.8	87	112	47
Rhode Island White Flint	E. P. Barnes, Norwich	2	White	Early	7,174	96	58.9	93	93	1,182
Rhode Island White Flint	A. C. Botham, Pomfret	3	White	Early	3,821	66	56.0	91	106	33
Rhode Island White Flint	W. P. Briggs, Lebanon	3	White	Early	3,767	67	56.3	92	106	19
Rhode Island White Flint	F. W. Newton, So. Canterbury	1	White	Early	4,373	76	54.0	82	98	106
Rhode Island White Flint	Rhode Island Exp. Station, Kingston, R. I.	9	White	Early	3,938	83	54.9	95	103	34
Rhode Island White Flint	A. A. Young, Jewett City	2	White	Early	6,435	87	59.4	94	101	26
Root's Yellow Flint	L. C. Root, Farmington	1	Yellow	Medium	3,022	55	48.0	80	103	71
Rosebrooks' Flint	Charles Rosebrooks, Storrs	2	Yellow	Early	2,632	50	52.0	76	103	150
Sanford White Flint	C. E. Hough, Washington	1	White	Medium	5,365	98	61.0	102	94	93
Sanford White Flint	Jesse St. John, Kent	7	White	Medium	4,731	105	59.4	108	100	150
Schultz's White Flint	W. F. Schultz, Saybrook	1	White	Medium	5,378	99	55.2	92	96	33
Sheffield Yellow Flint	Farm Dept., Conn. Agricultural College, Storrs	2	Yellow	Early	3,428	65	63.9	93	100	147
Sheffield Yellow Flint	C. H. Sage, East Canaan	4	Yellow	Early	2,569	54	45.5	83	109	18
Sheffield Yellow Flint	C. E. Borger, New Preston	4	Yellow	Early	2,782	62	50.2	90	105	31
Silver Triumph	C. J. Anderson, New Preston	1	White	Late	6,269	128	84.5	122	96	236
Skilton's Yellow Flint	Julius Skilton, Watertown	6	Yellow	Medium	5,354	107	59.8	102	97	177
Smut Nose Flint	G. A. Skilton, Watertown	3	White	Medium	3,400	80	46.7	89	99	100
Smut Nose Flint	Robert Skilton, Morris	4	White	Early	3,601	73	48.7	88	102	34
Stickney's Yellow Flint	G. E. Stickney, Newburyport, Mass	3	Yellow	Medium	4,807	87	59.2	89	99	108
Stickney's Yellow Flint	L. J. Grant, Wapping	3	Yellow	Medium	4,314	105	54.4	98	99	172
Taylor's Yellow Flint	G. E. Taylor, Shelburne, Mass	4	Yellow	Early	3,765	68	58.8	89	105	80
Tucker's Yellow Flint	F. E. Tucker, Vernon	3	Yellow	Early	3,320	62	56.3	86	106	112
U. S. Dept. of Agric. No. 193	Office of Cereal Investigations, Bureau of Plant Ind., Wash., D. C.	3	Yellow	Late	6,000	154	59.2	113	89	1,687
Wheaton's 12 Row	E. M. Wheaton, Putnam	2	Yellow	Medium	3,893	75	54.1	84	99	0
Yellow Dutton	C. H. Bissell, Lakeville	5	Yellow	Early	3,290	66	52.9	93	103	523
Yellow Dutton	H. Johnson, Washington	1	Yellow	Early	3,584	66	48.1	81	101	38
Zwick's Yellow Flint	Louis Zwick, Plantsville	6	Yellow	Medium	4,919	98	56.7	94	99	167

TABLE V DENT VARIETIES GROWN AT STORRS.

Variety.	Source of seed.	No. years tested.	Color.	Maturity.	Yield of stover pounds per acre.	Relative yield of stover per cent.	Yield of grain bushel per acre.	Relative yield of grain per cent.	Relative dry matter in ear corn per cent.	Relative per cent. soft corn per cent.
Bahler's White Dent	Adolph Bahler, Ellington	4	White	Medium	4,922	106	58.5	106	96	702
Brewer's Dent	N. H. Brewer, Hockanum	8	Yellow	Late	7,233	146	58.8	97	86	1,101
Brewer's Dent	B. F. Page, Durham	1	Yellow	Late	5,751	171	42.6	112	82	1,369
Century Dent	S. M. Waldron, New Milford	7	Yellow	Medium	4,535	103	62.4	116	94	319
Connecticut Dent	C. L. Howes, Stamford	5	Yellow	Late	6,587	122	63.0	98	91	987
Cornell No. 11	Dept. of Plant Breeding, Cornell Univ., Ithaca, N. Y.	3	Yellow	Early	3,595	91	57.0	102	97	108
Cornell No. 12	Dept. of Plant Breeding, Cornell Univ., Ithaca, N. Y.	3	Yellow	Medium	4,351	107	53.8	96	97	118
Dibble's Dent	Dibble Seed Co., Honeoye Falls, New York	3	Yellow	Late	7,642	144	63.4	96	88	87
Dowd Dent	R. C. Wilcox Sons, Guilford	5	Yellow	Medium	6,217	131	64.8	112	86	2,153
Eureka	Ross Bros. Seed, Co. Worcester, Mass.	2	White	Very late	19,077	371	44.4	66	67	928
Funk's 90 Day	Funk Bros. Seed Co., Bloomington, Ill	2	Yellow	Late	8,579	165	57.4	80	....	120
Golden Dent	P. H. Woodford, Avon	7	Yellow	Medium	5,801	119	61.9	102	85	1,295
Golden Dent	Alex Smith, Clintonville	1	Yellow	Late	5,225	121	43.2	113	88	1,288
Hastings' Yellow Dent	W. S. Hastings, Somers	2	Yellow	Very early	2,603	62	38.6	85	105	287
Hazenhurst White Cap	E. Hazen, Haddam	2	Yellow	Late	7,884	153	78.6	120	90	94
Herr's Yellow Dent	W. F. Herr, Brooklyn	2	Yellow	Medium	3,683	108	67.6	128	94	82
Hickory King	R. C. Wilcox Sons, Guilford	3	Yellow	Medium	5,141	116	61.2	111	91	614
Early Huron	Harris Seed Co., Coldwater, New York	4	Yellow	Medium	4,503	78	63.0	96	97	138
Early Huron	M. H. Williams, Sunderland, Mass	3	Yellow	Medium	4,682	82	67.6	106	94	60
Johnson's Yellow Dent	J. W. Moss, West Cheshire	3	Yellow	Late	7,226	184	62.7	110	85	1,271
Klondyke	George Hale, Westport	3	Yellow	Late	11,082	196	59.5	98	81	3,748
Lakeside Dent	N. Jones, South Windsor	8	Yellow	Late	6,301	141	60.9	108	92	401
Lakeside Dent	S. H. Peckham, Woodstock	2	Yellow	Medium	4,789	120	47.6	101	96	243
Leaming	H. Beardsley, Roxbury	7	Yellow	Medium	6,553	151	61.7	112	90	927
Leaming	J. B. Drake, Harwinton	1	Yellow	Medium	2,562	61	40.0	86	100	86

Mastodon	E. G. Packard, Dover, Del	2	Yellow	Very late	15,920	309	67.5	102	75	510
Early Michigan	G. A. Erskine, Guilford	3	Yellow	Medium	5,652	129	65.1	119	90	328
Minnesota White Cap	C. S. Griswold, West Hartford	4	Yellow	Medium	6,532	117	65.9	106	91	520
Minnesota No. 13	W. A. Stocking & Sons, Weatogue	3	Yellow	Early	2,834	70	43.1	89	105	504
New Hampshire No. 500	New Hampshire Experiment Station, Durham, N. H.	2	Yellow	Very early	1,920	43	46.2	72	106	247
Northern White Dent	B. W. Bishop, Guilford	5	White	Very late	8,413	171	61.4	109	77	4,978
Peck's Yellow Dent	W. O. Peck, East Haddam	3	Yellow	Medium	4,697	117	67.6	123	97	264
Pride of the North	Connecticut Agricultural College, Storrs	9	Yellow	Medium	5,346	114	59.7	104	95	554
Pride of the North	I. N. Hollister, Glastonbury	1	Yellow	Medium	5,293	92	49.7	76	92	92
Pride of the North	L. W. Kirk, Hamden	1	Yellow	Medium	5,766	106	44.4	74	97	88
Pride of the North	H. J. Larkham, Norwichtown	1	Yellow	Medium	4,304	79	48.3	81	100	27
Reynolds' Dent	W. W. Reynolds, New Britain	1	Yellow	Late	5,260	96	45.2	76	93	91
Sciota	B. F. Page, Durham	2	Yellow	Medium	3,727	111	52.0	111	103	631
Sharon White Cap	E. K. Dean, Sharon	7	Yellow	Medium	4,072	93	59.9	110	99	245
Silver King	Roy McDonald, Menomonie, Wisconsin	3	White	Medium	4,460	112	60.6	112	96	193
Sutton's Dent	R. C. Wilcox Sons, Guilford	3	Yellow	Late	6,354	145	61.8	111	88	1,126
Sweepstakes	S. L. Hollister, Washington	1	Yellow	Late	7,793	143	46.4	78	85	246
Sweepstakes	Alex. Smith, Clintonville	1	Yellow	Late	6,064	111	50.2	84	84	203
Sweepstakes	West Branch Seed Growers' Assn., Williamsport, Pa.	2	Yellow	Late	6,361	175	84.4	155	90	222
Tryon Dent	J. E. Daniels, Middletown	3	Yellow	Medium	5,248	92	69.8	109	96	37
U.S. Dept. of Agric. No. 119	Office of Cereal Investigations, Bureau of Plant Ind., Wash., D. C.	2	White	Very late	13,821	269	54.2	82	75	749
U.S. Dept. of Agric. No. 125	Office of Cereal Investigations, Bureau of Plant Ind., Wash., D. C.	1	Yellow	Late	7,955	162	98.3	142	89	56
U.S. Dept. of Agric. No. 133	Office of Cereal Invsetigations, Bureau of Plant Ind., Wash., D. C.	3	Yellow	Medium	3,292	83	51.8	97	98	114
Webber's Dent	Dept. of Plant Breeding, Cornell Univ., Ithaca, N.Y.	2	Yellow	Early	3,696	72	59.3	92	103	220
Webber's Dent	Willis Frost, Bridgewater	6	Yellow	Medium	6,086	141	61.9	114	78	795
White Cap	G. D. Hall, Wallingford	6	Yellow	Medium	3,486	69	51.9	88	97	479
White Cap	W. F. Herr, Brooklyn	3	Yellow	Medium	5,044	112	62.5	114	92	149
White Cap	L. C. Root & Son, Farmington	1	Yellow	Medium	6,268	128	83.6	121	94	0
White Cap	Henry Squires, New Milford	1	Yellow	Medium	3,717	88	59.3	103	98	38
White Cap	N. S. Strong, North Plain	2	White	Early	3,402	62	45.9	79	102	115
White Cap	Joseph Whathley, Kent	1	Yellow	Medium	3,497	104	43.7	114	96	544
White Cap	West Branch Seed Growers' Assn., Williamsport, Pa.	1	Yellow	Late	7,871	161	109.9	159	89	32
Woodford's Dent	G. C. Woodford, Plainville	2	Yellow	Medium	4,928	117	42.2	89	91	553

TABLE VI SILAGE CORN GROWN AT STORRS.

Variety.	Source of seed.	No. years tested.	Color.	Maturity.	Per cent. dry matter per cent.	Per cent. dry matter relative.	Actual green matter tons per acre.	Relative green matter per cent.	Actual dry matter per cent.	Relative dry weight per cent.
Bahler's White Dent	Adolph Bahler, Ellington	4	White	Early	27.2	134	11.8	59	3.3	80
Brewer's Dent	N. H. Brewer, Hockanum	7	Yellow	Late	24.3	119	14.4	68	3.2	79
Century Dent	S. M. Waldron, New Milford	6	Yellow	Early	27.4	134	12.5	60	3.4	80
Connecticut Dent	C. L. Howes, Stamford	4	Yellow	Medium	25.6	124	13.0	61	3.3	76
Cornell No. 11	Dept. of Plant Breeding, Cornell Univ., Ithaca, N. Y.	2	Yellow	Early	28.5	136	11.2	57	3.3	79
Cornell No. 12	Dept. of Plant Breeding, Cornell Univ., Ithaca, N. Y.	2	Yellow	Early	27.7	131	11.9	60	3.4	79
Curtain's Yellow Dent	E. Curtain, East Windsor	1	Yellow	Late	23.6	117	14.6	66	3.6	82
Dibble's Yellow Dent	Dibble Seed Co., Honeoye Falls, N. Y	2	Yellow	Medium	26.0	126	13.2	61	3.3	73
Dowd Dent	R. C. Wilcox Sons, Guilford	3	Yellow	Medium	25.1	123	14.4	71	3.4	82
Eureka	Ross Bros. Seed Co., Worcester, Mass	7	White	Very late	20.4	100	21.2	100	4.3	100
Funk's 90 Day	Funk Bros. Seed Co., Bloomington, Ill	3	Yellow	Late	24.5	119	15.5	71	3.7	82
Gelston's Ensilage	W. I. Gelston, East Haddam	5	Yellow	Late	23.2	109	15.8	75	3.6	81
Golden Dent	P. H. Woodford, Avon	6	Yellow	Medium	23.2	114	14.0	64	3.3	72
Golden Dent	Alex Smith, Clintonville	2	Yellow	Medium	23.9	122	11.9	58	2.9	73
Gold Nugget Flint	Mary Bacon, Kent	4	Yellow	Medium	25.4	126	12.8	61	3.2	75
Hastings Dent	W. S. Hastings, Somers	1	Yellow	Very early	34.7	172	7.3	47	2.6	80
Hazenhurst White Cap	E. Hazen, Haddam	2	Yellow	Medium	26.0	123	16.0	80	4.3	99
Herr's Yellow Dent	W. F. Herr, Brooklyn	1	Yellow	Early	32.4	148	13.6	54	4.3	77
Hickory King	Harry Carter, Guilford	3	Yellow	Early	27.5	136	12.9	63	3.5	86
Early Huron	Joseph Harris Co., Coldwater, N. Y	1	Yellow	Early	29.9	148	9.7	40	2.7	57
Early Huron	M. H. Williams, Sunderland, Mass	2	Yellow	Early	28.0	135	11.7	54	3.1	69
Johnson's Dent	J. W. Moss, West Cheshire	2	Yellow	Late	24.0	114	16.1	79	4.0	93
Klondyke	George Hale, Westport	4	Yellow	Very late	21.5	106	16.7	79	3.6	83
Lakeside Dent	N. Jones, South Windsor	4	Yellow	Medium	24.8	122	14.3	70	3.8	90
Lakeside Dent	S. H. Peckham, Woodstock	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Leaming	Farm Dept., Conn. Agric. College, Storrs	2	Yellow	Late	21.7	107	18.6	85	4.1	95
Leaming	Hurley Grant Hardware Co., Willimantic	1	Yellow	Late	19.4	106	15.6	73	3.1	78
Leaming	Thomas Griswold, Wethersfield	1	Yellow	Late	22.5	112	13.2	60	3.0	69
Leaming	Harrison Hamilton, Ellington	4	Yellow	Medium	26.2	129	12.0	59	3.2	77
Leaming	Ed. Harris, Middletown	1	Yellow	Medium	24.1	120	13.4	61	3.1	72
Leaming	W. A. Lanterman, Fairfield	2	Yellow	Medium	25.2	120	16.6	83	4.2	97
Leaming	Feed Store, Norwich	1	Yellow	Very late	20.0	99	7.3	46	1.4	43
Leaming	F. S. Prince, Xenia, Ohio	2	Yellow	Late	24.3	116	16.4	82	4.0	93
Leaming	W. H. Strong, Avon	4	Yellow	Medium	26.3	129	12.4	61	3.3	82
Leaming	Vinehill Farm, Elmwood	2	Yellow	Early	28.2	134	12.3	63	3.4	80
Leaming	W. J. Wells, South Deerfield, Mass	1	Yellow	Medium	23.4	128	11.8	55	2.8	71
Long Island Dent	C. E. Salmon, Brooklyn	1	Yellow	Early	28.3	140	9.5	61	2.8	88
Long's Champion Dent	Whitehorse Farms, Paoli, Pa	1	Yellow	Very late	19.2	90	21.2	108	3.9	92
Longfellow Flint	F. S. Platt Seed Co., New Haven	1	Yellow	Early	26.2	130	11.3	52	2.9	67
Luce's Favorite	Suffolk Co-operative Assoc., Mattituck, N. Y	2	Yellow	Late	23.3	111	16.8	83	3.8	90
Mammoth White Flint	O. S. Olmsted, Hazardville	3	White	Medium	25.3	122	14.5	68	3.5	80
Mammoth Yellow Flint	Louis Rosensweig, South Canterbury	1	White	Medium	24.9	124	12.5	57	3.2	73
Mastodon	S. D. Woodruff Seed Co., Orange	1	Yellow	Late	23.7	....	14.3	65	3.4	...
Mastodon	E. G. Packard, Dover, Delaware	7	Yellow	Very late	19.6	96	21.0	100	4.2	96
Mastodon	F. S. Platt Seed Co., New Haven	1	Yellow	Late	24.1	120	15.8	72	3.7	86
Early Michigan	G. A. Erskine, Guilford	2	Yellow	Medium	25.9	129	13.6	66	3.5	84
Minnesota No. 13	W. A. Stocking & Sons, Weatogue	1	Yellow	Very early	31.6	156	8.4	53	2.8	86
Minnesota White Cap	C. S. Griswold, West Hartford	4	Yellow	Medium	25.5	124	13.5	64	3.5	80
Northern White Dent	B. W. Bishop, Guilford	5	White	Late	22.3	109	17.2	85	3.8	92
Peck's Yellow Dent	W. O. Peck, East Haddam	2	Yellow	Early	28.9	138	14.1	70	4.1	96
Pride of the North	Connecticut Agricultural College, Storrs	7	Yellow	Early	26.2	128	12.4	59	3.3	75
Pride of the North	I. N. Hollister, Glastonbury	1	Yellow	Early	25.7	128	12.3	56	3.2	75
Pride of the North	L. W. Kirk, Hamden	1	Yellow	Early	26.7	132	11.9	76	3.2	98
Pride of the North	H. J. Larkham, Norwichtown	1	Yellow	Early	27.3	135	10.0	64	2.9	91
Red Cob	Platt Seed Co., New Haven	1	White	Late	20.3	101	18.7	85	3.6	83
Reynolds' Yellow Dent	W. W. Reynolds, New Britain	1	Yellow	Medium	26.1	129	9.3	59	2.7	85
Sanford White Flint	Jesse St. John, Kent	4	White	Early	26.2	130	12.3	58	3.2	75
Sharon White Cap	E. K. Dean, Sharon	3	Yellow	Early	28.6	142	11.4	56	3.2	78
Silver King	Roy McDonald, Menomonie, Wisconsin	2	White	Early	28.4	135	11.9	58	3.5	82
Stickney's Yellow Flint	G. E. Stickney, Newburyport, Mass	2	Yellow	Early	29.4	137	9.3	41	2.6	50

TABLE VI SILAGE CORN GROWN AT STORRS—*Concluded.*

Variety.	Source of seed.	No. years tested.	Color.	Maturity.	Per cent. dry matter: per cent.	Per cent. dry matter: relative.	Actual green matter tons per acre.	Relative green matter per cent.	Actual dry matter per cent.	Relative dry weight per cent.
Sutton's Dent	R. C. Wilcox Sons, Guilford	3	Yellow	Late	24.8	122	13.9	68	3.5	83
Sweepstakes	West Branch Seed Growers Assn., Williamsport, Pa.	1	Yellow	Medium	28.4	130	19.6	76	5.4	98
Sweepstakes	Alex Smith, Clintonville	1	Yellow	Late	21.9	109	15.2	96	3.4	105
Sweepstakes	S. L. Hollister, Washington	1	Yellow	Late	22.3	110	12.9	82	3.1	95
Tryon Dent	J. E. Daniels, Middletown	1	Yellow	Early	26.2	130	11.1	50	3.1	71
U. S. Dept. of Agric. No. 119	Office of Cereal Investigations, Bureau Plant Ind., Wash., D. C.	2	White	Very late	21.1	100	20.7	101	4.4	101
U. S. Dept. of Agric. No. 125	Office of Cereal Investigations, Bureau Plant Ind., Wash., D. C.	1	Yellow	Medium	26.1	120	18.1	72	4.7	85
U. S. Dept. of Agric. No. 133	Office of Cereal Investigations, Bureau Plant Ind., Wash., D. C.	2	Yellow	Very early	30.0	143	9.5	46	2.8	63
U. S. Dept. of Agric. No. 193	Office of Cereal Investigations, Bureau Plant Ind., Wash., D. C.	1	Yellow	Late	23.1	114	11.4	73	2.8	86
Webber's Dent	Willis Frost, Bridgewater	5	Yellow	Medium	24.5	119	13.8	68	3.4	81
Webber's Dent	Dept. Plant Breeding, Cornell Univ., Ithaca, N. Y.	2	Yellow	Early	30.8	146	9.9	50	3.1	73
White Cap	G. D. Hall, Wallingford	2	Yellow	Early	27.0	134	9.7	43	2.7	59
White Cap	W. F. Herr, Brooklyn	2	Yellow	Early	28.2	134	13.5	66	3.9	90
White Cap	L. C. Root & Son, Farmington	1	Yellow	Early	29.6	135	14.4	57	4.3	77
White Cap	N. S. Strong, North Plain	2	Yellow	Early	26.7	130	9.2	52	2.5	72
White Cap	West Branch Seed Growers Assn., Williamsport, Pa.	1	Yellow	Medium	28.0	128	18.4	73	5.2	95
Woodford's Dent	G. C. Woodford, Plainville	2	Yellow	Medium	24.0	125	11.0	62	2.6	75

DESCRIPTION OF VARIETIES.

Here follow decriptions of all varieties and strains tested. All are not illustrated. In all cases, the cut is for the variety description immediately below it.

Flint Varieties.

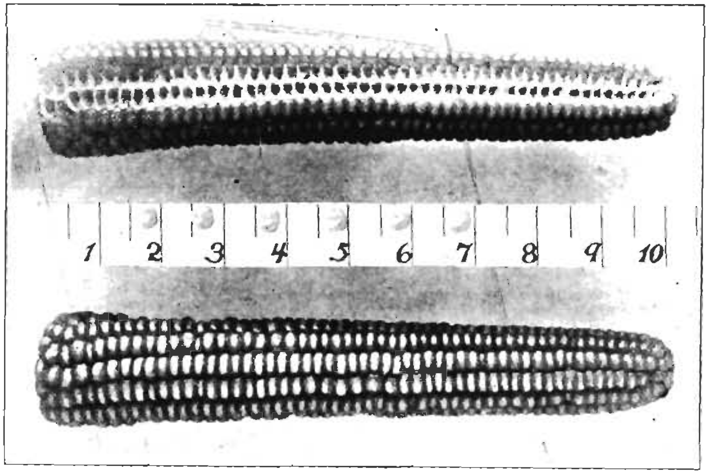

Figure 32.

Variety—Argentine Flint.
Source—S. D. LaBarr, Greenwich.*
Description—Stalk medium in height and size, with many suckers. Ear medium in length, large at butt and tapering. Kernels yellow, medium size, 12-14 rows. Matures well at Storrs.
History—Obtained seed in 1914 from a farmer near Buffalo, N. Y.

*All localities are in Connecticut unless otherwise noted.

FLINT VARIETIES—*Continued.*

Variety—Avery's White Flint.
Source—B. T. Avery, Ledyard.
Description—Stalk short, medium in diameter with many suckers. Ear long and cylindrical. Kernels white, medium size, 8 rows. Matures well at Storrs.
History—Unknown.

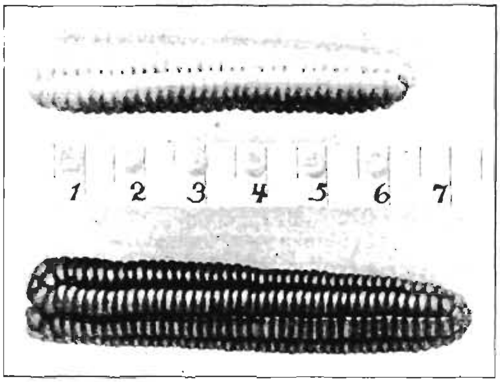

Figure 33.

Variety—Averill's Yellow Flint.
Source—Albert Averill, Pomfret Landing.
Description—Stalk short and small, with many suckers. Ear medium in length, small in diameter, small shank, slightly tapering. Kernels deep yellow, 8 rows. Matures very well at Storrs.
History—Seed obtained from Vermont about 40 years ago and has been grown on same farm since then.

Variety—Barnes White Flint.
Source—F. A. Barnes, Preston City.
Description—Stalk medium in height and diameter, with many suckers. Ear long and cylindrical. Kernels white, medium in size, 8 rows. Matures well at Storrs.
History—Unknown.

Variety—Beebe's Yellow Flint.
Source—C. M. Beebe, Uncasville.
Description—Stalk medium in height and diameter, with many suckers. Ears medium in length, large in diameter. Kernels yellow, large, 8 rows. Matures very well at Storrs.
History—Unknown.

FLINT VARIETIES—*Continued.*

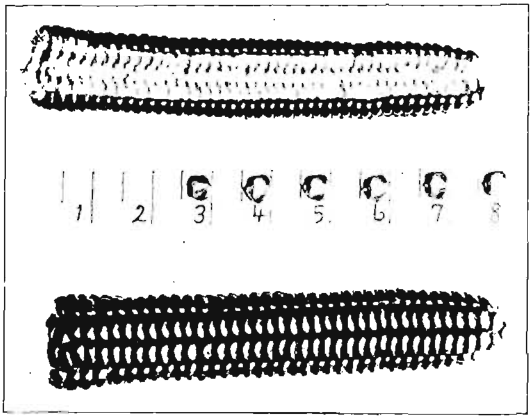

Figure 34.

Variety—Brewer's Flint.
Source—N. H. Brewer, Hockanum.
Description—Stalk medium in height, with many suckers. Kernels yellow, 8 rows. Matures very well at Storrs.
History—Unknown.

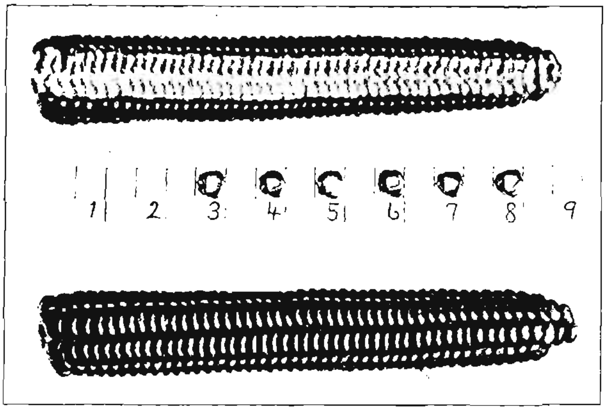

Figure 35.

Variety—Burwell's Flint.
Source—E. E. Burwell, New Haven.
Description—Stalk medium in height and diameter, with many suckers. Ear medium in length and diameter. Kernels yellow, medium size, 8 rows. Matures well at Storrs.
History—A selection of Canada Yellow Flint. Grown 25 years by Mr. Burwell.

FLINT VARIETIES—*Continued.*

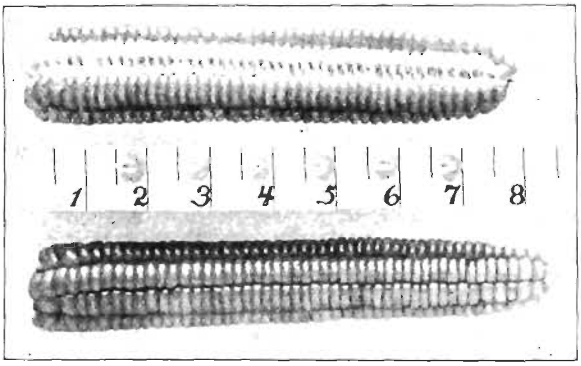

Figure 36.

Variety—Canada Yellow Flint.
Source—Thomas Griswold and Sons, South Wethersfield.
Description—Stalk medium in height, large in diameter, with few suckers. Ear medium in length, cylindrical. Kernels yellow, medium size, 8 rows. Matures well at Storrs.
History—Grown for at least 12 years.

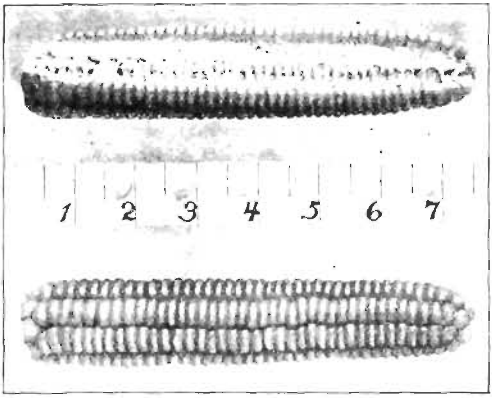

Figure 37.

Variety—Canada Yellow Flint.
Source—Jason Lathrop, Plainfield.
Description—Stalk short, medium in size and number of suckers. Ear medium in length and diameter, cylindrical, small shank. Kernels yellow, medium size, 8 rows. Matures very well at Storrs.
History—Grown for 50 years on same farm.

FLINT VARIETIES—*Continued.*

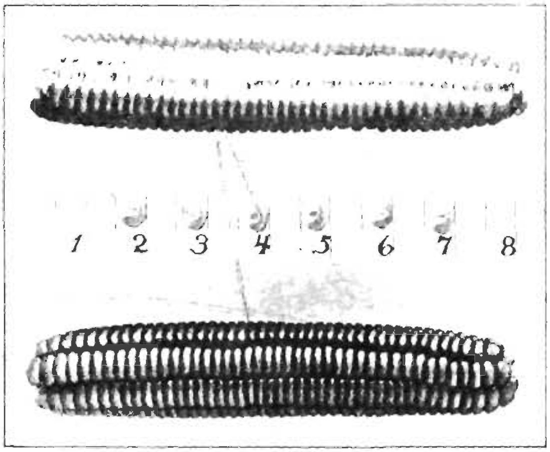

Figure 38.

Variety—Chace's Yellow Flint.
Source—M. W. Chace, Pomfret Landing.
Description—Stalk short, medium in diameter, with many suckers. Ear medium in length, large, cylindrical. Kernels yellow, medium size, 8 rows. Matures very well at Storrs.
History—Brought into vicinity of Pomfret from Rhode Island in 1841. Originally called "Hawkins Corn."

Variety—Connecticut Yellow Flint.
Source—O. S. Olmsted, Hazardville.
Description—Stalk short and small, with many suckers. Ear medium in length and diameter, well capped. Kernels yellow, large and close together, 8 rows. Matures very well at Storrs.
History—Seed from Canada 60 years ago. Mr. Olmsted has crossed it twice with other yellow flints since then. Seed selected carefully.

Variety—Canada Yellow Flint.
Source—L. S. Abbe, Hazardville.
Description—Stalk short and small, suckers medium in number. Ear short, medium in diameter, tapering. Kernels yellow, medium size, 8 rows. Matures very well at Storrs.
History—Grown for 50 years on same farm without change.

FLINT VARIETIES—*Continued.*

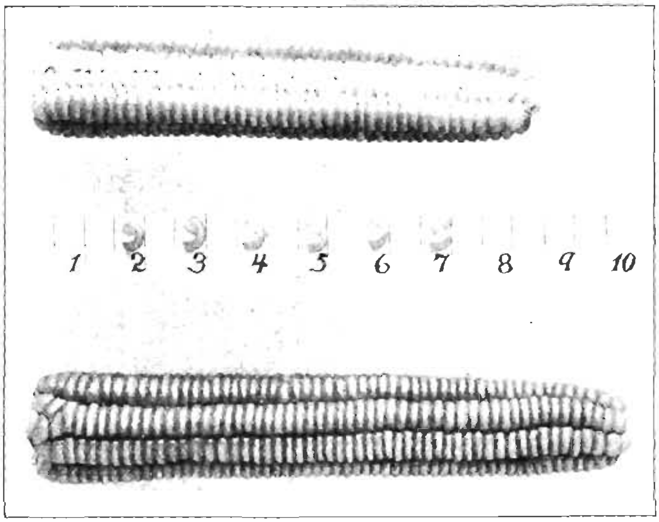

Figure 39.

Variety—Crowell's Prolific.
Source—David Crowell, Middletown.
Description—Stalk tall and large. Ear long, cylindrical. Kernels yellow, 8 rows. Matures fairly well at Storrs.
History—Grown for 100 years on the same farm, originally brought from Massachusetts.

Variety—Double Capped White Flint.
Source—W. A. Thrall, Windsor.
Description—Stalk very short and very small, with many suckers. Ear very short and very small, cylindrical, very well capped at tip and butt, shank very small. Kernels white, of medium depth and size, 8 rows. Matures very well at Storrs.
History—Unknown.

Variety—Fairview Flint.
Source—Harrison Hamilton, Ellington.
Description—Stalk short and small, with few suckers. Ear medium in length and size. Kernels yellow, 8 rows. Matures very well at Storrs.
History—Unknown.

Variety—Fenn's 12 Row.
Source—R. M. Fenn, Middlebury.
Description—Stalk medium in height, small in diameter, with few suckers. Ear medium in length, large in diameter. Kernels dark yellow, medium depth, small, 12 rows. Matures at Storrs.
History—A selection from Basham's Longfellow.

FLINT VARIETIES—*Continued.*

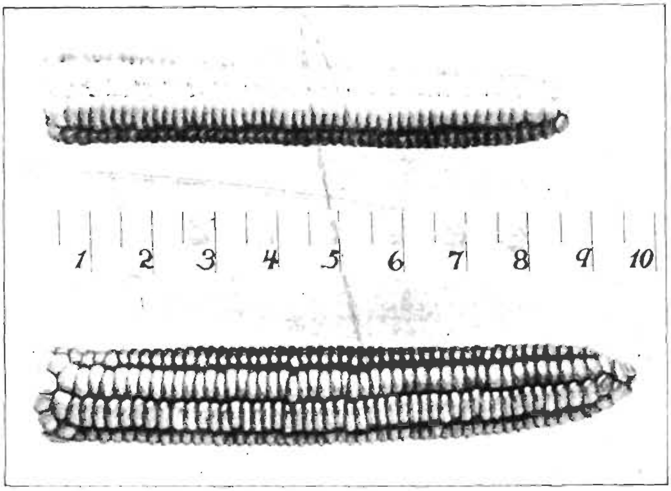

Figure 40.

Variety—Davis Yellow Flint.
Source—P. E. Davis, Granby, Mass.
Description—Stalk medium in height and diameter, with few suckers. Ear medium in length. Kernels yellow, 8 rows. Matures very well at Storrs.
History—Originated from a cross of a flint of the Longfellow type with a small cob, amber colored variety. Has existed as a distinct variety about 38 years.

Variety—Frost's Yellow Flint.
Source—Charles Frost, Sherman.
Description—Stalk medium in height and diameter, with few suckers. Ear medium in length, small in diameter. Kernels variable in color, largely yellow, medium depth and size. Matures well at Storrs.
History—Said to have originated as a cross of different varieties. Obtained from W. H. Taber of Quaker Hill, Pawling, New York over 40 years ago.

FLINT VARIETIES—*Continued.*

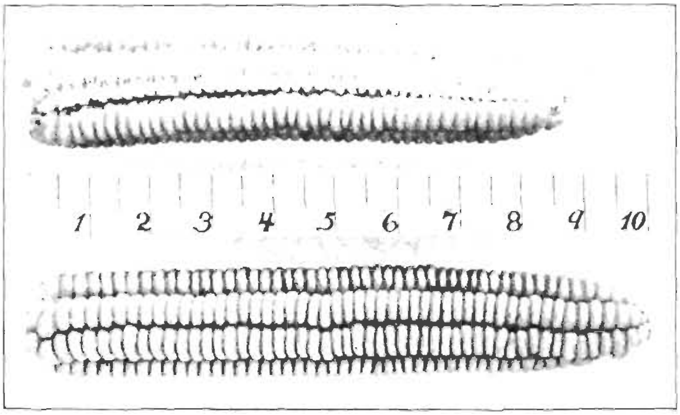

Figure 41.

Variety—Gold Nugget.
Source—Mary Bacon, Kent.
Description—Stalk medium in height, large, with very few suckers. Ear medium in length, very large in diameter, rather coarse. Kernels light yellow, medium depth, very large, 8 rows. Matures fairly well at Storrs.
History—Hall's Golden Nugget from Joseph Harris Seed Co., Coldwater, New York, grown about fourteen years in Kent. Originated by Levi P. Hall about 1873.

Variety—Gold Nugget.
Source—A. L. Purdy, Port Chester, N. Y.
Description—See Bacon's Gold Nugget.

Variety—Gold Nugget.
Source—J. B. Stratton, Watertown.
Description—See Bacon's Gold Nugget. Seed from same source.

Variety—Hathaway's Yellow Flint.
Source—Auburn, Maine.
Description—Stalk short and small, with few suckers. Kernels yellow, 8 rows. Matures very well at Storrs.
History—Unknown.

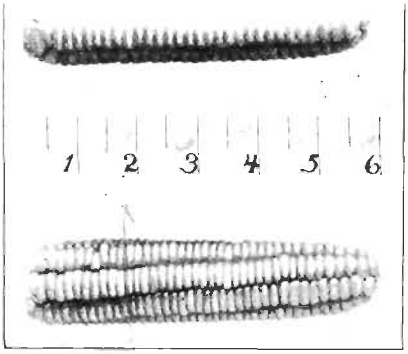

Figure 42.

Variety—Griswold's 90 Day.
Source—Thomas Griswold and Sons, Wethersfield.
Description—Stalk short and small, with few suckers. Ear short and small, cylindrical, well capped, small shank. Kernels yellow, 8 rows. Matures very well at Storrs.
History—Known to have been grown in the vicinity for at least 12 years.

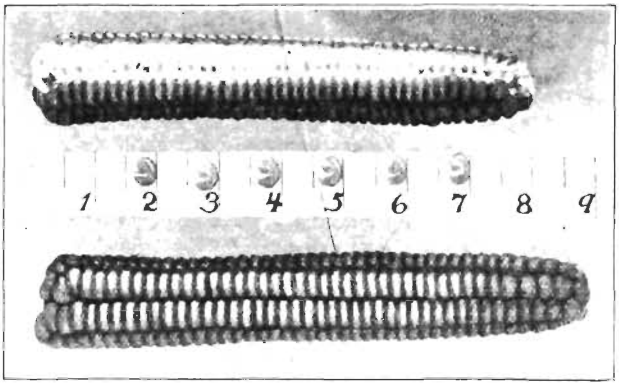

Figure 43.

Variety—Hauschild's Yellow Flint.
Source—Julius Hauschild, Storrs.
Description—Stalk medium in height and diameter, with many suckers. Ear medium in length. Kernels variable in color, mostly yellow, 8 rows. Matures well at Storrs.
History—Has been mixed with other strains of different color.

FLINT VARIETIES—*Continued.*

Variety—Hayes' Canada Flint.
Source—M. C. Hayes, Granby.
Description—Stalk medium height with many suckers. Kernels yellow, 8 rows. Matures at Storrs.
History—Unknown.

Variety—Healey's Yellow Flint.
Source—L. H. Healey, Woodstock.
Description—Stalk short and small, with few suckers. Ear medium in length and diameter. Kernels yellow, medium depth and size, 8 rows. Matures very well at Storrs.
History—The result of a cross between Sheffield flint from Massachusetts and Early Canada from New Hampshire. Grown for ten years.

Variety—Isben's Yellow Flint.
Source—J. C. Isben, North Haven.
Description—Stalk medium in height and diameter with few suckers. Ear medium in length, large in diameter. Kernels yellow, medium depth and size, 8 rows. Matures fairly well at Storrs.
History—Seed obtained from F. S. Platt Seed Co. about 14 years ago.

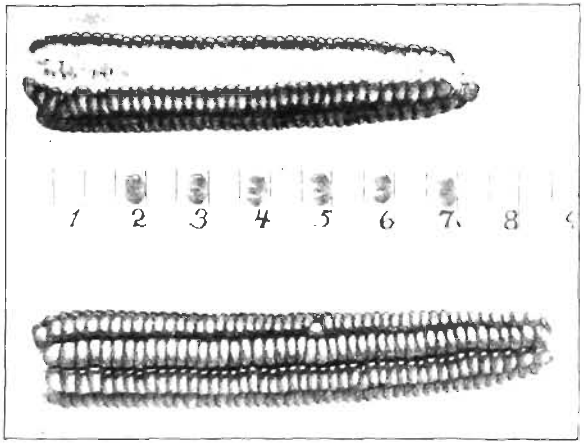

Figure 44.

Variety—King Philip.
Source—W. E. Price, Warehouse Point.
Description—Stalk medium in height and diameter with few suckers. Ear rather short, medium diameter, cylindrical, well capped. Kernels red, of medium depth and size, 8 rows. Matures very well at Storrs.
History—Brought from Rhode Island about 35 years ago.

Flint Varieties—*Continued.*

Variety—Longfellow.
Source—John Basham, Middlebury.
Description—Stalk medium in height and diameter and number of suckers. Ear long and small in diameter. Kernels dark yellow, medium depth and size. 8 rows. Matures at Storrs.
History—Unknown.

Variety—Longfellow.
Source—P. J. Behan, Roxbury.
Description—Stalk medium in height and diameter, with few suckers. Ear long, small in diameter. Kernels yellow, shallow, medium size, 8 rows. Matures well at Storrs.
History—Mr. Behan selects his seed from stalks with two ears.

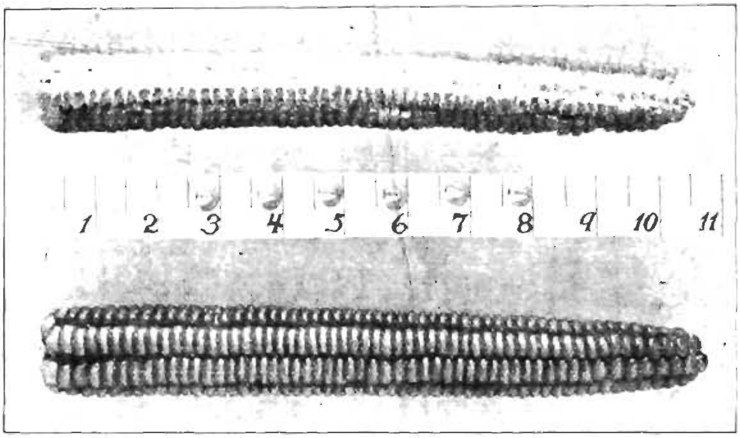

Figure 45.

Variety—Longfellow.
Source—N. G. Gelston, Sherman.
Description—Stalk of medium height, rather small in diameter, with few suckers. Ear long, small in diameter. Kernels yellow, shallow, medium size, 8 rows. Matures well at Storrs.
History—Mr. Gelston has grown this strain for 10-15 years. Uncertain as to source. Selects his seed at husking.

Variety—Longfellow.
Source—F. S. Platt Seed Co., New Haven.
Description—Stalk medium in height. Ear long. Kernels yellow, 8 rows. Matures well at Storrs.
History—Seed grown in Connecticut.

FLINT VARIETIES—*Continued.*

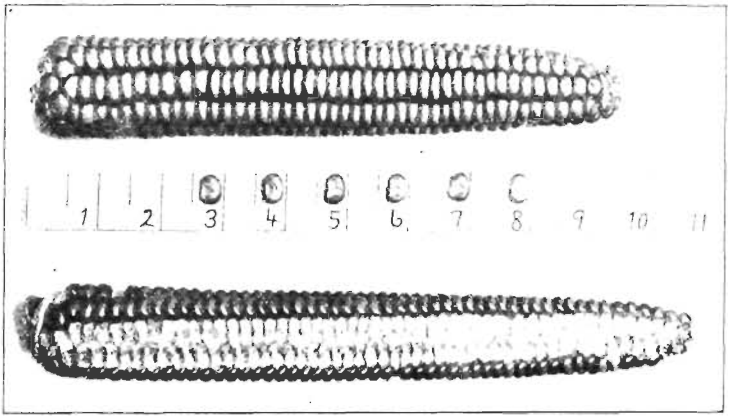

Figure 46.

Variety—Longfellow.
Source—Reuben Keeler, Bridgewater.
Description—Stalk medium in height and diameter with few suckers. Ear long, small in diameter. Kernels dark yellow, shallow, medium size, 8 rows. Matures well at Storrs.
History—Is mixed with Pied Flint, a variety of similar type.

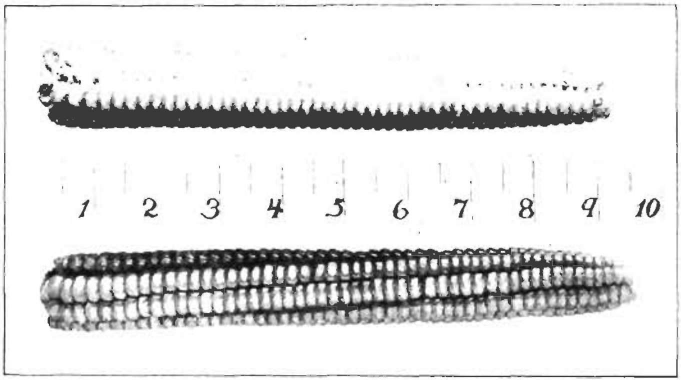

Figure 47.

Variety—Longfellow.
Source—N. R. Mosher, Sherman.
Description—See Keeler's Longfellow.
History—Unknown.

FLINT VARIETIES—*Continued.*

Variety—Longfellow.
Source—C. H. Savage, Storrs.
Description—Stalk medium in height. Kernels yellow, 8 rows. Matures well at Storrs.
History—Unknown.

Variety—Mammoth White Flint.
Source—O. S. Olmsted, Hazardville.
Description—Stalk tall and large, with few suckers. Ear long and large in diameter. Kernels white, 8 rows. Matures at Storrs.
History—Unknown.

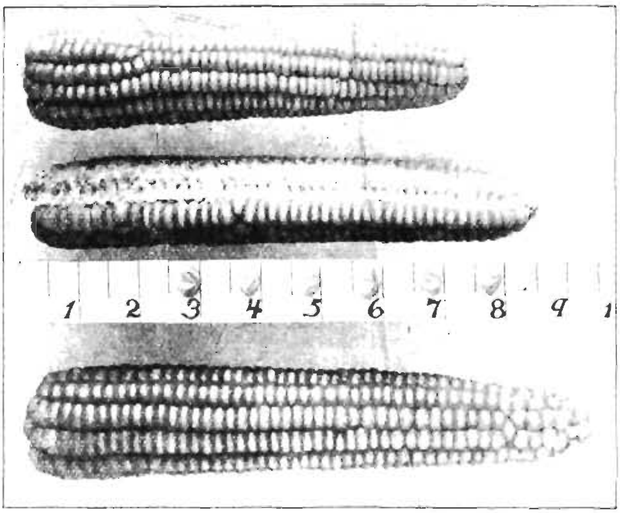

Figure 48.

Variety—Mammoth Yellow Flint.
Source—Louis Rosensweig, South Canterbury.
Description—Stalk tall. Ear long, small shank, slightly tapering. Kernels light yellow, 8–12 rows. Matures at Storrs.
History—Unknown.

FLINT VARIETIES—*Continued.*

Variety—McLean's Flint.
Source—J. B. McLean, Simsbury.
Description—Stalk medium in height and diameter, with many suckers. Ear medium in length and diameter, cylindrical. Kernels yellow, medium depth and size, 8 rows. Matures well at Storrs.
History—Mr. McLean crossed a strain of Canada Yellow Flint with a much larger variety ten years ago and by careful selection since then has obtained the corn described here. It has won several prizes at corn shows.

Variety—Montgomery's White Flint.
Source—Phelps Montgomery, Mt. Carmel.
Description—Stalk medium in height, many suckers. Ear medium in length. Kernels white, 8 rows. Matures at Storrs.
History—Seed purchased from Peter Henderson Seed Co., grown several years in Connecticut.

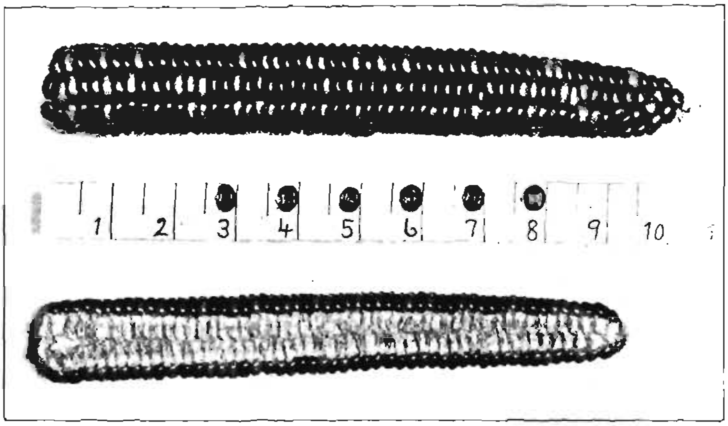

Figure 49.

Variety—Pied Flint.
Source—Reuben Keeler, Bridgewater.
Description—Stalk medium in height and diameter, with few suckers. Ear long, rather small in diameter, cylindrical. Kernels vary in color, white or yellow, rather shallow, of medium size, 8 rows. Matures fairly well at Storrs.
History—This variety is the result of crossing yellow and white flints. Has been grown for sixty years. Seed obtained from Lyman Smith. Selects seed at husking.

Variety—Red Flint.
Source—Albert Hale, South Coventry.
Description—Stalk short. Ear medium in length. Kernels red, 8 rows. Matures very well at Storrs.
History—Unknown.

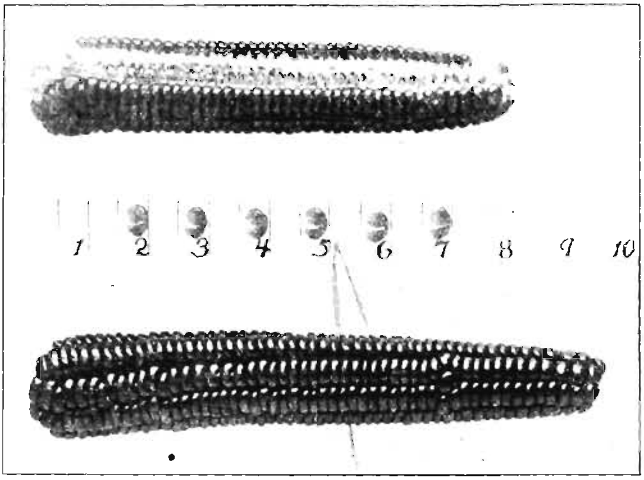

Figure 50.

Variety—Red Flint.
Source—Benjamin Neleber, Colchester.
Description—Stalk medium in height and diameter, with few suckers. Ears medium in length and diameter. Vary in color, red or yellow and white. Matures well at Storrs.
History—Unknown.

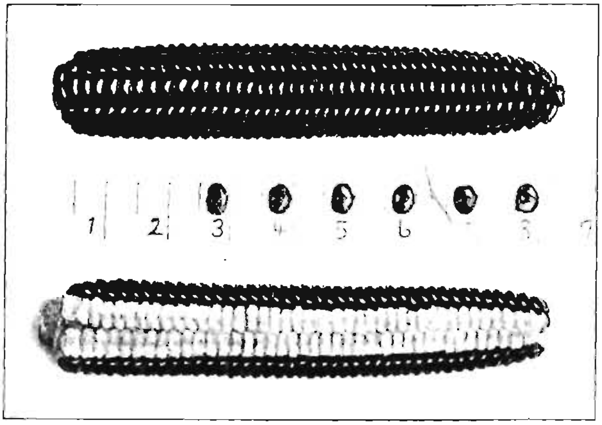

Figure 51.

Variety—Red Flint.
Source—S. F. Brown, Windsor.
Description—Stalk medium in height, diameter and number of suckers. Ear medium in length. Kernels red, medium size and depth, 8 rows. Matures very well at Storrs.
History—Is a strain of King Philip known as Hill's Red Flint.

FLINT VARIETIES—*Continued.*

Variety—Red Glaze.
Source—J. H. Wilson, Baltic.
Description—Stalk medium in height, large in diameter, with few suckers. Ear medium in length, slightly tapering, well capped. Kernels white except those at tip which are pinkish, 8 rows. Matures very well at Storrs.
History—Was grown in South Swansea, Mass., for many years, where it matured in about 105 days.

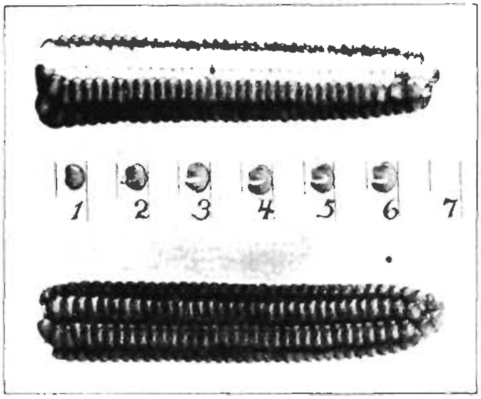

Figure 52.

Variety—Rhode Island Premium.
Source—W. J. Clark, Woodbury.
Description—Stalk short and very small in diameter, with many suckers. Ear short and small, cylindrical, well capped. Kernels red, medium in depth and size, 8 rows. Matures very well at Storrs.
History—Has been grown on same farm for thirty years. Mr. Clark obtained seed from R. W. Martin of Woodbury. Selected seed for past seven years from two and three-eared stalks.

Variety—Rhode Island White Fliut.
Source—E. P. Barnes, Norwich.
Description—Stalk medium in height and diameter, with many suckers Ear medium in length and diameter, slightly tapering. Kernels white, medium in depth, rather large, 8 rows. Matures at Storrs.
History—Grown forty years on the same farm. Originally from Rhode Island.

Variety—Rhode Island White Flint.
Source—R. C. Botham, Pomfret.
Description—Stalk short and small in diameter, with many suckers. Ear short, medium in diameter and well capped. Kernels white, large, 8 rows Matures well at Storrs.
History—Unknown.

FLINT VARIETIES—*Continued.*

Variety—Rhode Island White Flint.
Source—W. P. Briggs, Lebanon.
Description—Stalk short and small in diameter, with many suckers. Ear short, medium in diameter, cylindrical, well capped. Kernels white, shallow, large, 8 rows. Matures well at Storrs.
History—Mr. Briggs has grown this variety for 30 years. Obtained his seed from Robert Carpenter, also of Lebanon.

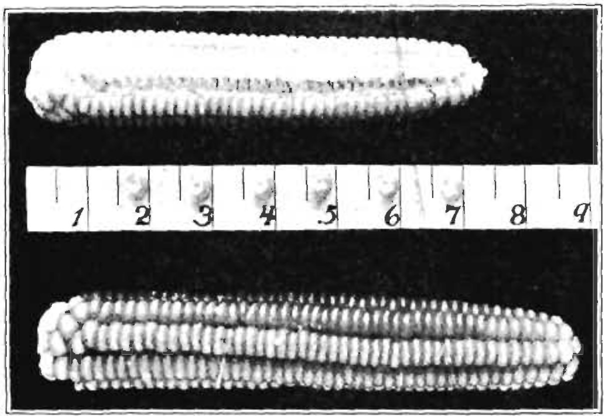

Figure 53.

Variety—Rhode Island White Flint.
Source—F. W. Newton, South Canterbury.
Description—Stalk medium in height. Ear medium in length, slightly tapering, long type of Rhode Island White. Kernels white, large, 8 rows. Matures at Storrs.
History—Unknown.

Variety—Rhode Island White Flint.
Source—A. A. Young, Jewett City.
Description—See R. I. Exper. Station's White Flint
History—Originally from Rhode Island Experiment Station.

FLINT VARIETIES—*Continued.*

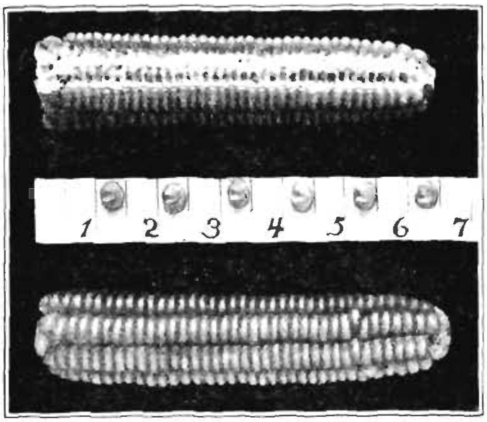

Figure 54.

Variety—Rhode Island White Flint.
Source—Rhode Island Experiment Station, Kingston, R. I.
Description—Stalk medium in height, small in diameter, with many suckers. Ear short, medium in diameter, well capped. Kernels white, medium depth and size, 8 rows. Matures well at Storrs.
History—Grown on the Experiment Station farm for at least 10 years. Originally from F. E. Marchant in the same locality who has raised this corn for a long period of time.

Variety—Root's Yellow Flint.
Source—L. C. Root, Farmington.
Description—Ear short and very small. Kernels yellow, shallow, medium in size, 8 rows. Matures well at Storrs.
History—Unknown.

Variety—Sanford White Flint.
Source—C. E. Hough, Washington.
Description—See St. John's Sanford White Flint.
History—Mr. Hough obtained his seed from Albert Carlson of New Milford, who in turn obtained his from Kent.

FLINT VARIETIES—*Continued.*

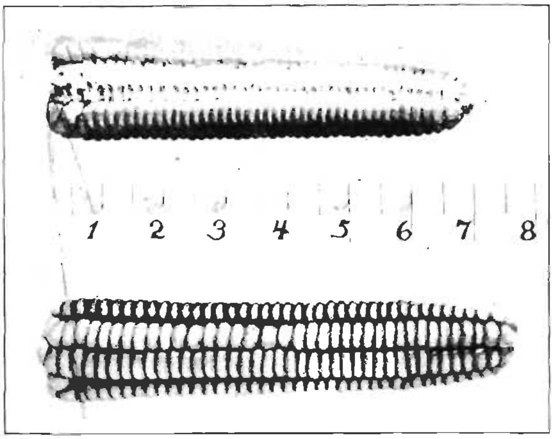

Figure 55.

Variety—Rosebrooks' Flint.
Source—Charles Rosebrooks, Storrs.
Description—Stalk short. Ear medium length. Kernels yellow, 8 rows. Matures well at Storrs.
History—Grown for nearly fifty years on same farm.

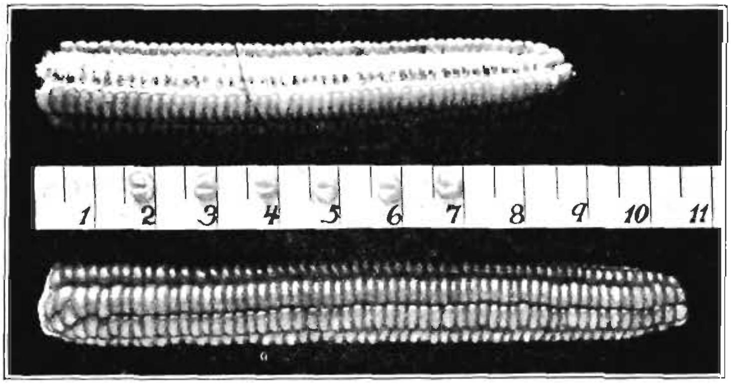

Figure 56.

Variety—Sanford White Flint.
Source—Jesse St. John, Kent.
Description—Stalk medium in height and diameter, with few suckers. Ear medium in length and diameter, cylindrical. Kernels white, of medium depth and size, 8 rows. Matures well at Storrs.
History—Grown for 30 years or more on the same farm. Original source unknown.

Variety—Schultz's White Flint.
Source—W. F. Schultz, Saybrook.
Description—Ear of medium length and diameter. Kernels white, of medium depth and size, 8 rows. Matures well at Storrs.
History—Unknown.

Variety—Sheffield Yellow Flint.
Source—Farm Department, Connecticut Agricultural College, Storrs.
Description—Stalk medium in height. Ear medium in length. Kernels yellow, 8 rows. Matures well at Storrs.
History—Unknown.

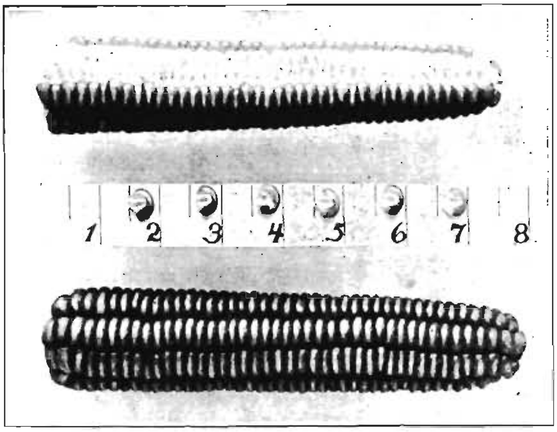

Figure 57.

Variety—Sheffield Yellow Flint.
Source—C. H. Sage, New Canaan.
Description—Stalk medium in height, small in diameter, with few suckers. Ear short and of medium diameter. Kernels yellow, 8 rows. Matures very well at Storrs.
History—Mr. Sage has grown this strain for 12–15 years, obtaining his original seed from James Cahill, Sheffield, Mass., and two years ago from Peck Brothers, Sheffield, Mass.

Variety—Sheffield Yellow Flint.
Source—C. E. Borger, New Preston.
Description—See Healey's Yellow Flint.
History—Obtained seed from Massachusetts in 1909.

Variety—Silver Triumph.
Source—C. J. Anderson, New Preston.
Description—Stalk medium in height, large in diameter, with few suckers. Ear medium in length, large in diameter; kernels white, deep, large, 8 rows. Matures fairly well at Storrs.
History—Mr. Anderson obtained his seed in 1920 from A. A. Biery Seed Co., Clarinda, Iowa. Matured in 100 days in 1920.

FLINT VARIETIES—*Continued.*

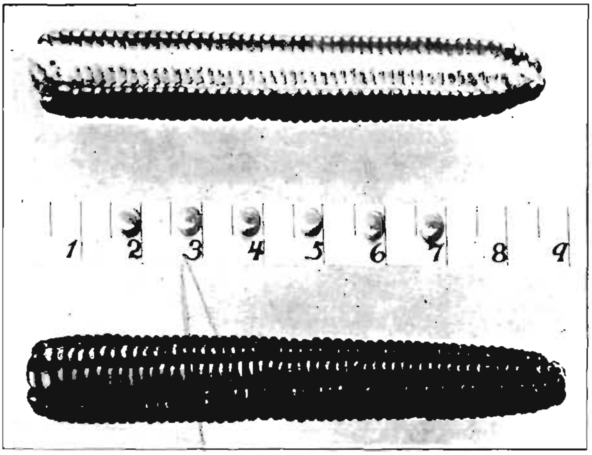

Figure 58.

Variety—Skilton's Yellow Flint.
Source—Julius Skilton, Watertown.
Description—Stalk of medium height and diameter, with few suckers. Ear medium in length, small in diameter, tapers very little. Kernels dark yellow, shallow, of medium size, 8 rows. Matures well at Storrs.
History—Has been grown for fifty-three years on the same farm. Seed selected very carefully at husking time. Originally from New York.

Variety—Smut Nose Flint.
Source—G. A. Skilton, Watertown.
Description—Stalk medium in height, small in diameter. Ear medium in length and diameter. Kernels white, except those at tip, which are pinkish, of medium depth and size, 8 rows. Matures well at Storrs.
History—Grown for 40 years on the same farm. Originally from Robert Skilton.

Variety—Stickney's Yellow Flint.
Source—G. E. Stickney, Newburyport, Mass.
Description—Stalk of medium height and diameter, with few suckers. Ear medium in length and diameter, cylindrical. Kernels yellow, 8 rows. Matures well at Storrs.
History—This variety is the result of crossing and careful selection of the hybrid for cylindrical well-capped ears.

Variety—Stickney's Yellow Flint.
Source—L. J. Grant, Wapping.
Description—Stalk medium in height and diameter, with few suckers. Ear medium in length, small in diameter. Kernels yellow, shallow, of medium size, 8 rows. Matures well at Storrs.
History—See G. E. Stickney's Yellow Flint.

FLINT VARIETIES—*Continued.*

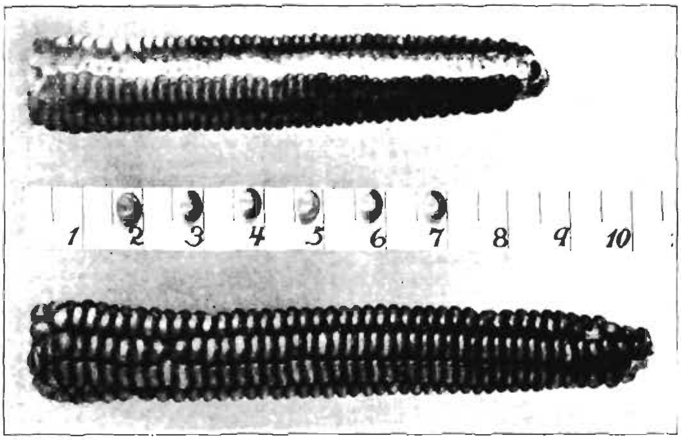

Figure 59.

Variety—Smut Nose Flint.
Source—Robert Skilton, Morris.
Description—See G. A. Skilton's Smut Nose White Flint
History—Mr. Skilton and his father have grown this variety for 62 years on the same farm. Select seed at husking.

Variety—Taylor's Yellow Flint.
Source—G. E. Taylor, Shelburne, Mass.
Description—Stalk medium in height, diameter and number of suckers. Ear medium in length. Kernels dark yellow, 8 rows. Matures very well at Storrs.
History—Brought from South Hadley in 1814 and raised on the same farm for 110 years.

Variety—U. S. Department of Agriculture No. 193.
Source—Office of Cereal Investigations, B. of P. I., Washington, D. C.
Description—Stalk tall and large with few suckers. Ear medium in length, very large in diameter, resembling "Gold Nugget." Kernels light yellow, deep, very large, 8 rows. Does not mature well at Storrs.
History—A selection from Hall's Golden Nugget secured from Jacob Kotzenstein of Hamburg, New Jersey, in 1914. Bred by the U. S. Dept. of Agriculture from 1915 to 1921 at Rhinebeck, New York. See Bacon's Gold Nugget.

Variety—Wheaton's 12 Row.
Source—E. M. Wheaton, Putnam.
Description—Stalk medium in height, small in diameter, with few suckers. Ear medium in length, large in diameter. Kernels dark yellow, shallow, small, 12 rows. Matures very well at Storrs.
History—Result of crossing 12 rowed dent with 8 rowed flint. Grown for 15 years.

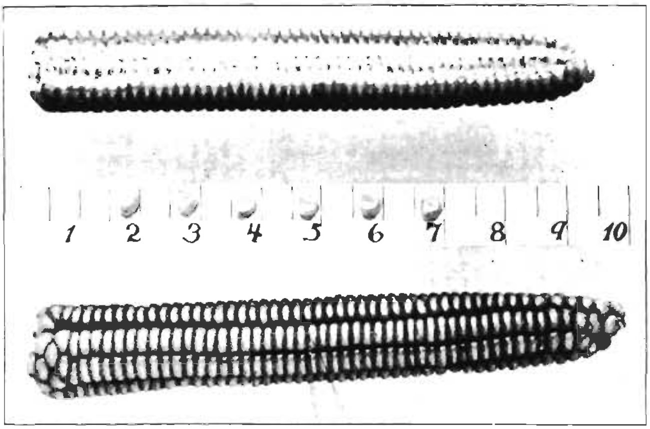

Figure 60.

Variety—Tucker's Yellow Flint.

Source—F. E. Tucker, Vernon.

Description—Stalk medium in height and diameter, with few suckers. Ear short. Kernels yellow, 8 rows. Matures well at Storrs.

History—This variety is the result of crossing Canada Yellow Flint with Holden's about thirty years ago; since then seed has been selected very carefully in the field.

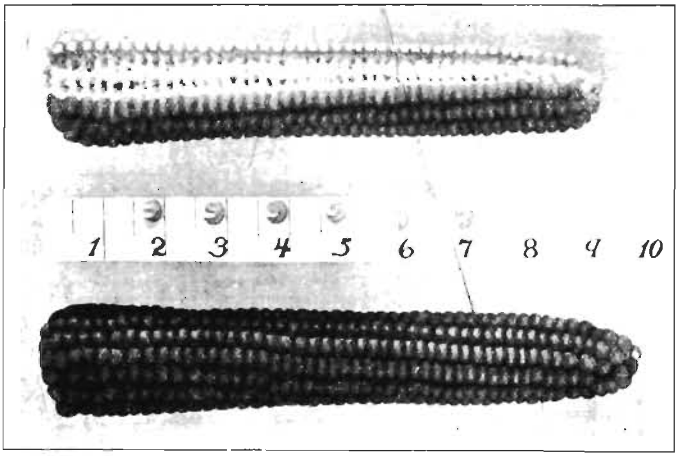

Figure 61.

Variety—Yellow Dutton.

Source—C. H. Bissell, Lakeville.

Description—Stalk of medium height and small in diameter, with a medium number of suckers. Ears medium in length, large at butts. Kernels light yellow, shallow, small, 12 rows. Matures well at Storrs.

History—Grown for fifty years by Mr. Bissell.

FLINT VARIETIES—*Concluded.*

Variety—Yellow Dutton.
Source—H. Johnson, Washington.
Description—Stalk of medium height, small in diameter. Ear medium in length, small in diameter. Kernels light yellow, of medium depth, small, 12 rows.
History—Unknown.

Variety—Zwick's Yellow Flint.
Source—Louis Zwick, Plantsville.
Description—Stalk of medium height and diameter, with few suckers. Ear medium in length and diameter. Kernels light yellow, of medium depth and size, 8 rows. Matures fairly well at Storrs.

DENT VARIETIES.

Variety—Bahler's White Dent.
Source—Adolph Bahler, Ellington.
Description—Stalk medium in height and small in diameter. Ear rather short and thick. Kernels white, deep, medium in size, 16–20 rows. Matures very well at Storrs.
History—Originally from Illinois. Grown in Ellington for 20 years.

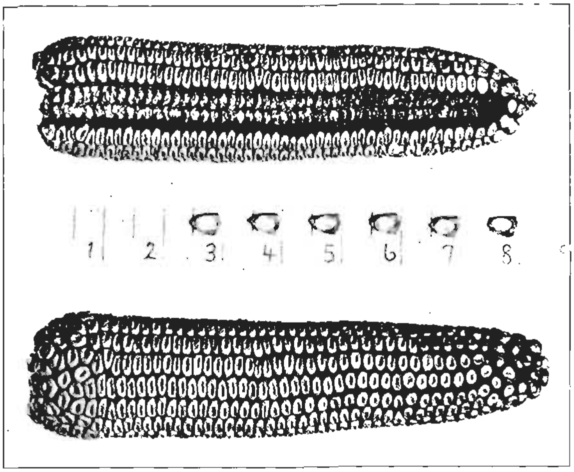

Figure 62.

Variety—Brewer's Dent.
Source—N. H. Brewer, Hockanum.
Description—Stalk tall and large. Ear medium in length and thickness. Kernels yellow, deep, rather small, 16–20 rows. Does not mature at Storrs.
History—Result of several years' selection out of Reid's Yellow Dent, by N. H. Brewer.

Variety—Brewer's Dent.
Source—B. F. Page, Durham.
Description—Stalk medium in height and diameter. Ear short and thick. Kernels yellow, 16–22 rows. Does not mature at Storrs.
History—From N. H. Brewer.

DENT VARIETIES—*Continued.*

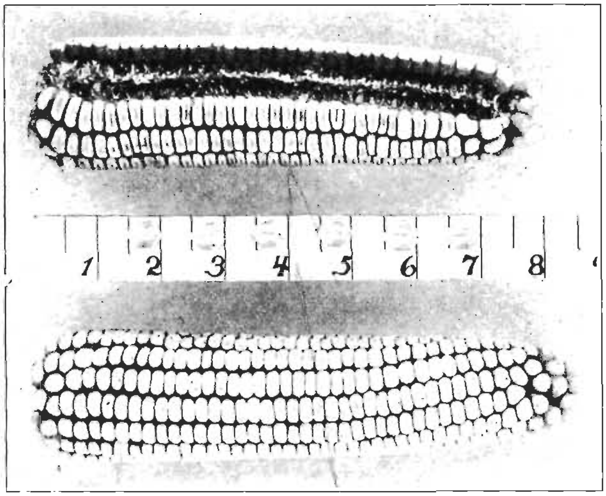

Figure 63.

Variety—Century Dent.
Source—S. M. Waldron, New Milford.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels yellow, deep, medium in size, 14–18 rows. Matures well at Storrs.
History—Bought in Buffalo, N. Y., about 1902 from a silo company. Supposed to be a pedigreed corn.

Variety—Clark's Early Wonder.
Source—Harris Seed Company, Coldwater, N. Y.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels yellow, deep, medium in size, moderately to roughly indented, 14–18 rows.
History—Obtained seed about ten years ago from Clark & Son, Wayland, Michigan.

Variety—Dibble's Yellow Dent.
Source—Dibble Seed Company, Honeoye Falls, N. Y.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels yellow, 12-16 rows. Does not mature well at Storrs.
History—A strain of Leaming selected and grown by the Dibble Seed Company.

DENT VARIETIES—*Continued.*

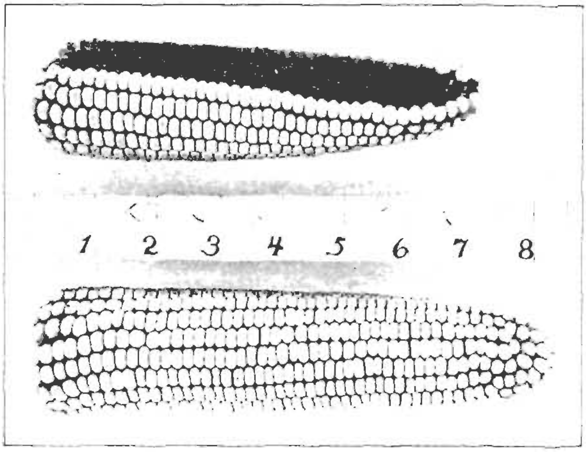

Figure 64.

Variety—Connecticut Dent.
Source—C. L. Howes, Stamford.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels yellow, 16–18 rows. Does not mature well at Storrs.
History—From Dibble's Early Yellow Dent. Bred by "ear to row" method by Mr. Howe.

Variety—Cornell No. 11.
Source—Dept. of Plant Breeding, Cornell University, Ithaca, N. Y.
Description—Stalk short and slender. Ear short and medium in diameter. Kernels yellow, mediumly deep, small, 12–20 rows. Matures very well at Storrs.
History—Isolated from Pride of the North by eight years of ear-to-row selection in Cayuga Co., New York.

Variety—Cornell No. 12.
Source—Dept. Plant Breeding, Cornell University, Ithaca, N. Y.
Description—Stalk short and slender. Ear short and large in diameter. Kernels yellow, deep, medium in size, 18–20 rows. Matures well at Storrs.
History—Isolated from Funk's 90 Day by five years of ear-to-row selection in Westchester Co., New York.

Variety—Curtin's Yellow Dent.
Source—E. Curtin, East Windsor.
Description—Stalk tall, medium in diameter. Ear long and tapering. Kernels yellow. Does not mature at Storrs.
History—Unknown.

DENT VARIETIES—*Continued.*

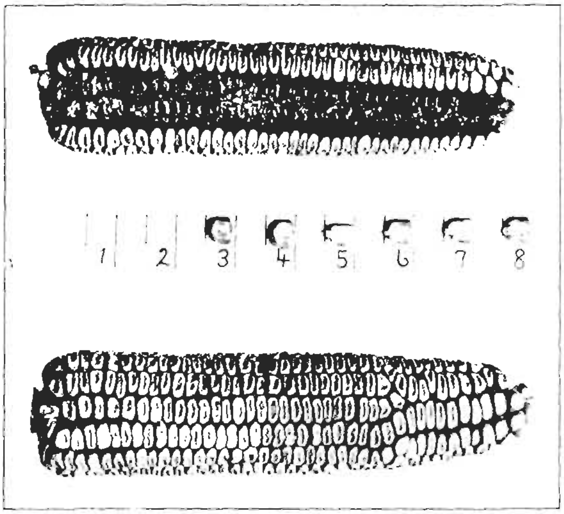

Figure 65.

Variety—Dowd Dent.

Source—R. C. Wilcox & Sons, Guilford.

Description—Stalk medium in height and diameter. Ear long. Kernels light yellow, 10-14 rows. Matures fairly well at Storrs.

History—Unknown.

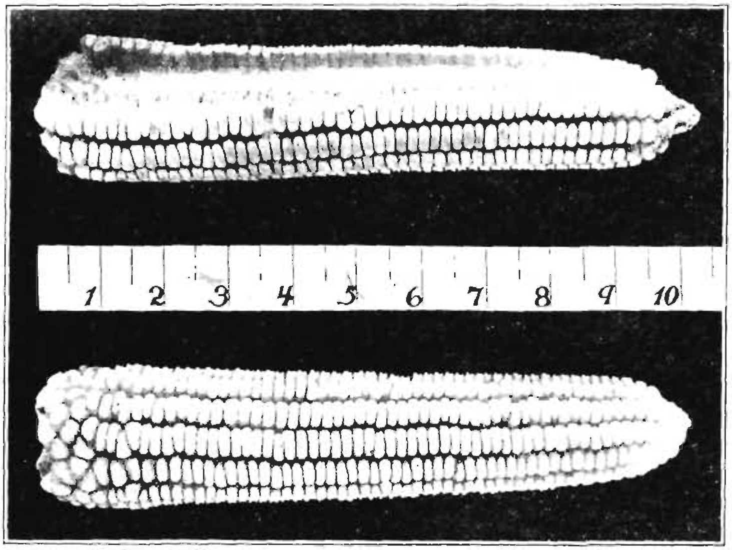

Figure 66.

Variety—Eureka.

Source—Ross Brothers Seed Company, Worcester, Mass.

Description—Stalk very tall and very large. Ear long and large. Kernels white, mediumly deep and very broad. Never matures at Storrs.

History—Grown on James River in Virginia.

DENT VARIETIES—*Continued.*

Variety—Yellow Eureka.
Source—Peter Henderson & Company, New York City.
Description—Tall, large silage variety.
History—Grown by I. S. Long, Richland, Lebanan County, Penn., about 20 years ago.

Variety—Funk's 90 Day.
Source—Funk Bros. Seed Company, Bloomington, Ill.
Description—Stalk tall and quite large. Kernels yellow, 14-18 rows. Does not mature well at Storrs.
History—Originated by E. D. Funk in 1892 from a selection following a cross of a small eared early corn and a late variety.

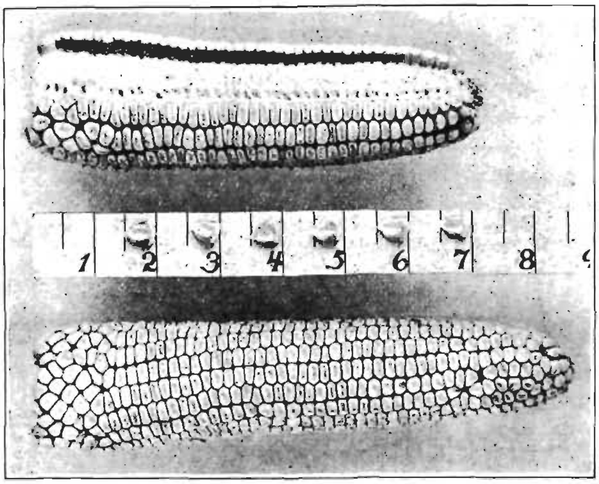

Figure 67.

Variety—Gelston's Ensilage.
Source—W. I. Gelston, East Haddam.
Description—Stalk tall and large. Ear long, large and slightly tapering Kernels yellow, roughly dented. Does not mature at Storrs.
History—The result of crossing Early Mastodon on Klondyke.

Variety—Golden Dent.
Source—Alex Smith, Clintonville.
Description—Stalk medium in height, small. Ear short, medium in diameter. Kernels reddish yellow, 12-14 rows. Matures at Storrs.
History—Grown in Clintonville for several years.

DENT VARIETIES—*Continued.*

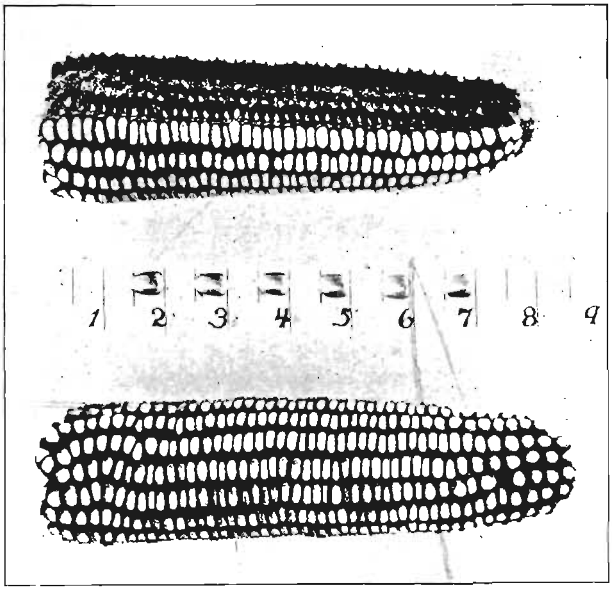

Figure 68.

Variety—Golden Dent.
Source—P. H. Woodford, Avon.
Description—Stalk medium in height and diameter. Ear medium in length, large. Kernels reddish yellow, deep, medium size, 14-16 rows. Matures at Storrs.
History—Grown for 25 years on Mr. Woodford's farm.

Variety—Hasting's Yellow Dent.
Source—W. S. Hastings, Somers.
Description—Stalk short and small. Ear short and small. Kernels deep yellow, mediumly deep, small, 14-16 rows. Matures very well at Storrs.
History—Mr. Hastings had grown it for several years. He obtained the seed from his brothers in Shelburne, Mass. Brought from West originally.

Variety—Hazenhurst White Cap.
Source—E. Hazen, Haddam.
Description—Stalk tall and large. Ear medium in length, large in diameter. Kernels yellow with white cap, deep, large, 12-16 rows. Requires a favorable season to mature at Storrs.
History—Unknown.

Variety—Herr's Yellow Dent.
Source—W. F. Herr, Brooklyn.
Description—Stalk medium in height, small, ear medium in length, large in diameter. Kernels yellow, medium in depth and size, 14 rows. Matures at Storrs.
History—Unknown.

DENT VARIETIES—*Continued.*

Variety—Hickory King.
Source—R. C. Wilcox & Sons, Guilford.
Description—Stalk medium in height, large. Ear medium in length, small in diameter. Kernels yellow, shallow, very large, 8 rows. Matures at Storrs.
History—Unknown.

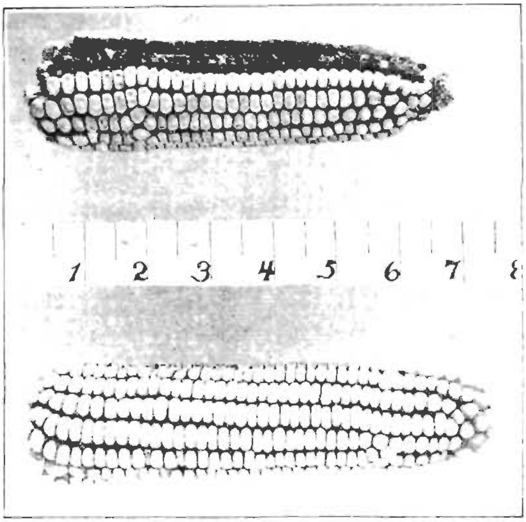

Figure 69.

Variety—Early Huron.
Source—Joseph Harris Company, Coldwater, N. Y.
Description—Stalk short and small. Ear medium in length. Kernels deep yellow, 14-16 rows. Matures well at Storrs.
History—Grown in western New York near Lake Ontario for many years.

Variety—Holcomb's Dent.
Source—P. Holcomb, East Granby.
Description—Stalk medium in height. Kernels yellow, slender 14-18 rows, widely spaced. Matures at Storrs.
History—Grown and seed selected for 20 years by Mr. Holcomb.

Variety—Johnson's Dent.
Source—J. W. Moss, West Cheshire.
Description—Stalk medium in height and large in diameter. Ear long and large. Kernels light yellow, deep, medium in size, 14-16 rows. Does not mature very well at Storrs.
History—Unknown.

DENT VARIETIES—*Continued.*

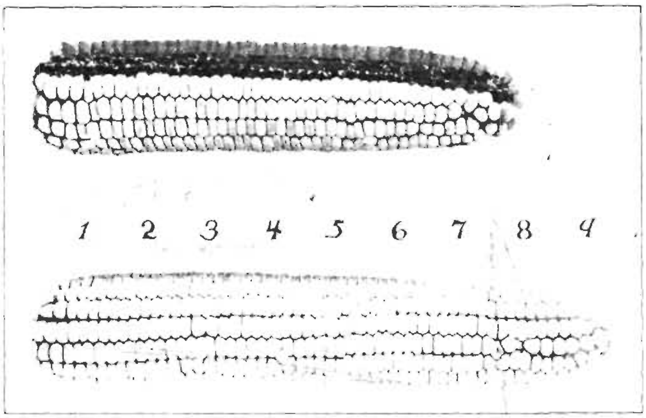

Figure 70.

Variety—Early Huron.
Source—M. H. Williams, Sunderland, Mass.
Description—Stalk medium in height and diameter. Ear medium in length. Kernels deep yellow, 14-16 rows. Matures at Storrs.
History—Result of crossing Early Huron and Pride of North. Selected for several years since.

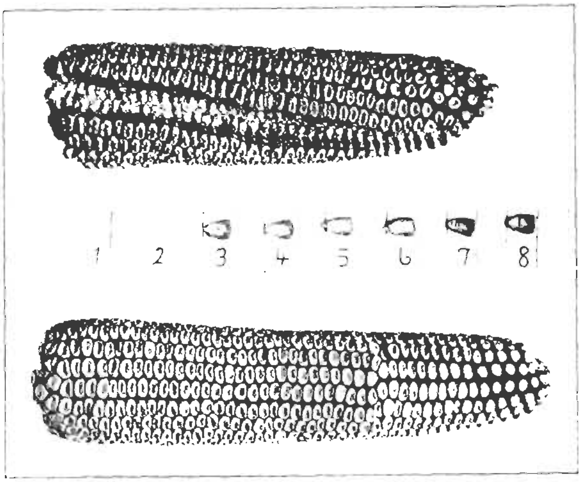

Figure 71.

Variety—Klondyke.
Source—George Hale, Westport.
Description—Stalk tall and large. Ear long and large. Kernels light yellow, 14-16 rows. Does not mature at Storrs.
History—Unknown.

DENT VARIETIES—*Continued.*

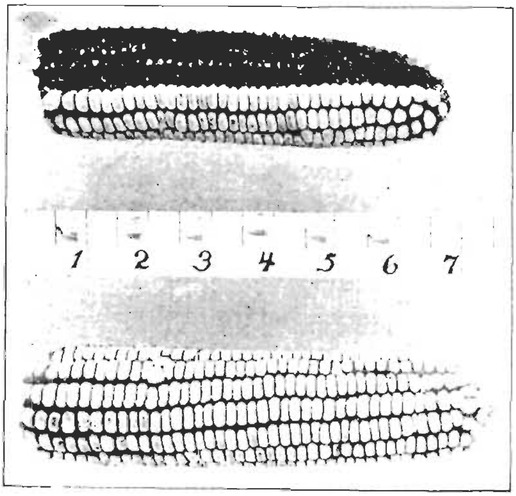

Figure 72.

Variety—Lakeside Dent.
Source—Nathaniel Jones, South Windsor.
Description—Stalk medium in height and diameter. Ear medium in length, large at butt and tapering. Kernels yellow, deep, medium in size, 14-16 rows. Usually matures fairly well at Storrs.
History—Mr. Jones obtained seed from W. F. Cobb & Company, Franklin, Mass. Originally from A. A. Chatfield of Fulton County, Ohio.

Variety—Lakeside Dent.
Source—S. H. Peckham.
Description—Stalk shorter and smaller than preceding variety. Ears short, medium in diameter and tapering. Kernels deep yellow, medium in depth and size, 12-18 rows. Matures at Storrs.
History—Mr. Peckham obtained his seed from Nathaniel Jones of South Windsor in 1917 and had selected his own seed since.

Variety—Lancaster Sure Crop.
Source—Lancaster County, Penn.
Description—Stalk medium in length and diameter. Ears long and slender, tapering. Kernels deep yellow, smooth and broad, 16-20 rows.
History—Originated by Mr. Isaac E. Hershey of Lancaster County, Penna.

Variety—Leaming.
Source—Dibble Seed Company, Honeoye Falls, N. Y.
Description—Stalk of medium height. Kernels yellow, 14-20 rows. Not tested for grain at Storrs.
History—Seed grown at Honeoye Falls, N. Y.

DENT VARIETIES—*Continued.*

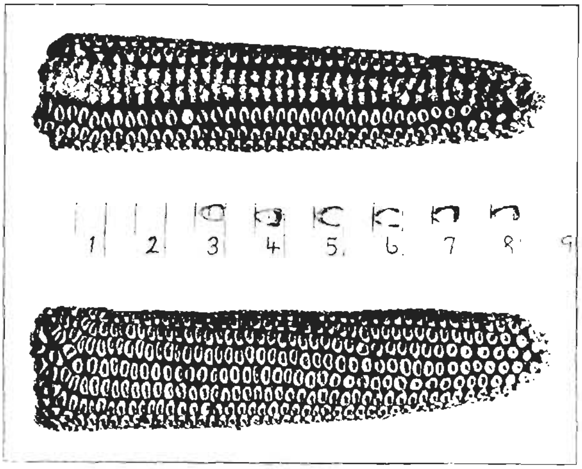

Figure 73

Variety—Leaming.
Source—Heman Beardsley, Roxbury.
Description—Stalk medium in height and diameter. Ear medium in length and diameter, tapering. Kernels dark yellow, medium in depth and size, 16-22 rows. Matures at Storrs.
History—Mr. Beardsley obtained seed from Ed. Seeley of Roxbury about 1905 and since has acclimated it to his conditions. Selects his seed at husking or in the crib.

Variety—Leaming.
Source—Peter Henderson Seed Company, New York City.
Description—Stalk medium in height. Kernels yellow, 14-22 rows. Not tested for grain at Storrs.
History—Unknown.

Variety—Leaming.
Source—Farm Department, Connecticut Agricultural College, Storrs.
Description—Stalk medium in height. Kernels yellow, 14-18 rows. Never tested for grain at Storrs.
History—Unknown.

Variety—Leaming.
Source—Hurley Grant Hardware Company, Willimantic.
Description—Stalk tall and large. Kernels yellow. Never tested for grain at Storrs.
History—Local company obtained seed from Dickinson Seed Company, N. Y. City.

Variety—Leaming.
Source—Thomas Griswold, So. Wethersfield.
Description—Stalk medium in height and diameter. Not tested for grain at Storrs.
History—Unknown.

DENT VARIETIES—*Continued.*

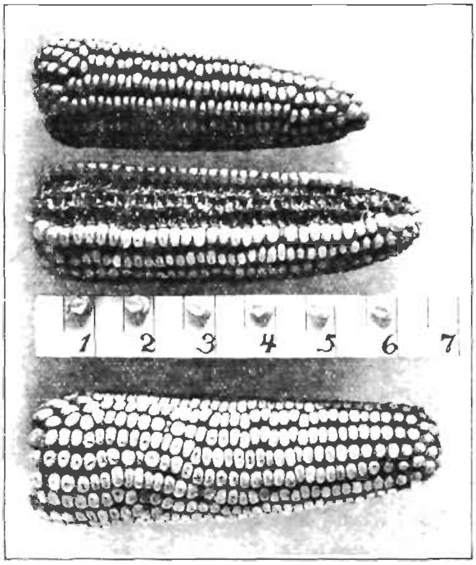

Figure 74.

Variety—Leaming.
Source—L. P. Drake, Harwinton.
Description—Stalk short and small. Ear short and small. Kernels yellow, narrow, very little denting. 12-16 rows. Matures very well at Storrs.
History—Originally from West. Mr. Drake obtained his seed from Chas. Alford of Harwinton about 1909.

Variety—Leaming.
Source—Harrison Hamilton, Ellington.
Description—Stalk medium in height and diameter. Ear medium in length, small. Kernels yellow, medium in depth and size, 12-16 rows. Matures well at Storrs.
History—Mr. Hamilton has grown this variety for several years.

Variety—Leaming.
Source—Ed. Harris, Middletown.
Description—Stalk short and small. Ear medium in length, tapering. Kernels yellow. Not tested for grain at Storrs.
History—Unknown.

Variety—Leaming.
Source—W. A. Lanterman, Fairfield.
Description—Stalk medium in height, large in diameter. Ear medium in length, small in diameter. Kernels deep yellow, shallow, medium in size, 12-14 rows. Matures well at Storrs.
History—Mr. Lanterman has grown this variety for several years and has matured it nicely, even in years of very early frosts.

DENT VARIETIES—*Continued.*

Variety—Leaming.
Source—Feed Store, Norwich.
Description—Stalk tall and large. Kernels yellow. A very late strain of Leaming. Does not mature at Storrs.
History—Unknown.

Variety—Leaming.
Source—F. S. Prince, Xenia, Ohio.
Description—Stalk medium in height and large in diameter. Ear long and large. Kernels light yellow, deep, medium in size, 16-20 rows. Does not mature at Storrs.
History—This is a selected strain of the original Ohio Leaming variety.

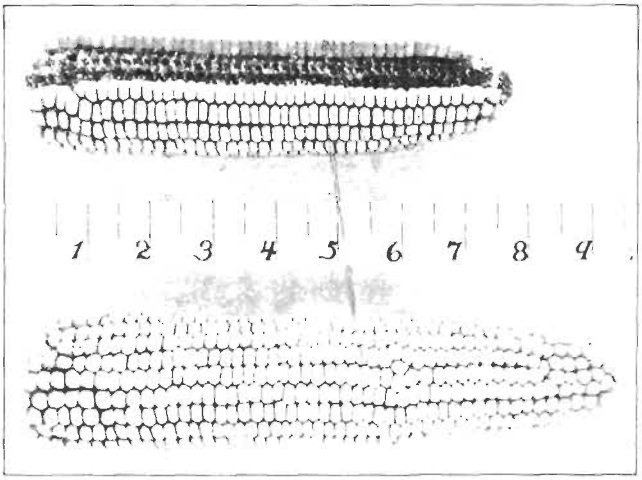

Figure 75.

Variety—Leaming.
Source—W. H. Strong, Avon.
Description—Stalk medium in height, small in diameter. Ear short and small. Kernels yellow, medium in depth and size, 14-16 rows. Matures at Storrs.
History—Mr. Strong obtained seed from Cadwell and Jones of Hartford in 1912.

Variety—Leaming.
Source—Vinehill Farm, Elmwood.
Description—Stalk medium in height and diameter. Ear medium in length, large. Kernels yellow, medium in depth and size, 12-16 rows. Matures at Storrs.
History—Western Leaming grown about 30 years in Connecticut, carefully selected for ear type from individual plants in the field.

Variety—Leaming.
Source—W. J. Wells, So. Deerfield, Mass.
Description—Stalk medium in height and diameter. Ear rather short. Kernels yellow, 12-16 rows. Matures well at Storrs.
History—Unknown.

DENT VARIETIES—*Continued.*

Variety—Long Island Dent.
Source—C. E. Salmon, Brooklyn.
Description—Stalk short and small in diameter. Ear medium in length, small. Kernels reddish yellow, shallow, large, 8 rows. Only slightly dented and looks like a flint. Matures well at Storrs.
History—Mr. Salmon brought the seed from Long Island several years ago and has grown it in Brooklyn since. It has now become acclimated.

Variety—Long's Champion.
Source—Whitehorse Farms, Paoli, Pa.
Description—Stalk very tall and very large in diameter. Ear long and very large. Kernels light yellow, 14-22 rows. Does not mature at Storrs.
History—Unknown.

Variety—Luce's Favorite.
Source—Suffolk Cooperative Association, Mattituck, N. Y.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels yellow or white, shallow, large, 8 rows, slightly dented, intermediate in type between dent and flint corn. Does not mature at Storrs.
History—Unknown.

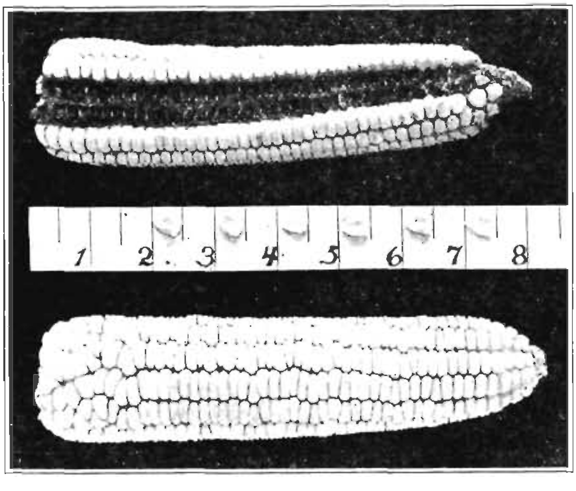

Figure 76.

Variety—Mason's White Dent.
Source—W. W. Chappell, North Franklin.
Description—Stalk short and small. Ear short. Kernels white, 12-16 rows. Matures very well at Storrs.
History—Mr. Mason obtained his seed from N. S. Strong of North Plains about 15 years ago.

Variety—Mastodon.
Source—S. D. Woodruff Seed Company, Orange.
Description—Stalk tall and large. Does not mature at Storrs.
History—Seed obtained each year from Ohio.

DENT VARIETIES—*Continued.*

Variety—Mastodon.
Source—E. G. Packard, Dover, Del.
Description—Stalk very tall and very large. Ear long and very large. Kernels yellow, deep, very large, 18-20 rows. Does not mature at Storrs.
History—Unknown.

Variety—Mastodon.
Source—F. S. Platt Seed Co., New Haven.
Description—Stalk medium in height. Does not mature at Storrs.
History—Seed usually obtained from Ohio.

Variety—Early Michigan.
Source—G. A. Erskine, Guilford.
Description—Stalk medium in height and large in diameter. Ear medium in length, large in diameter. Kernels reddish yellow, deep, large, 12-16 rows. Matures at Storrs.
History—Unknown.

Variety—Minnesota No. 13.
Source—W. A. Stocking & Sons, Weatogue.
Description—Stalk short and small. Ear short, small. Kernels yellow, medium in depth, small, 12-16 rows. Matures very well at Storrs.
History—Grown for 12-15 years in Weatogue.

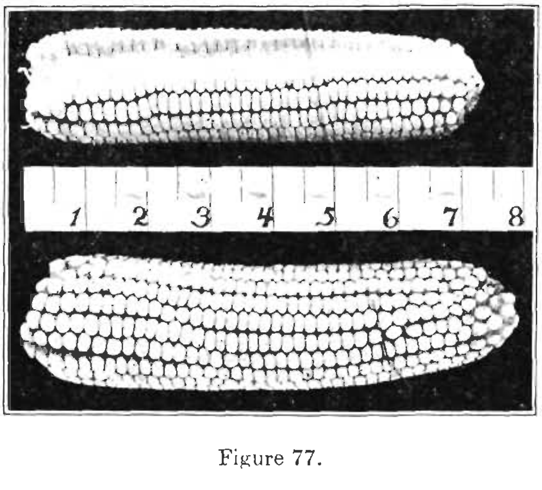

Figure 77.

Variety—Minnesota White Cap.
Source—C. S. Griswold, West Hartford.
Description—Stalk medium in height and diameter. Ear medium in length, cylindrical. Kernels yellow with white caps. 12-16 rows. Matures well at Storrs.
History—Originated from about a dozen stalks found growing in a field of Canada Flint corn about 20 years ago.

DENT VARIETIES—*Continued.*

Variety—Montgomery's White Dent.
Source—Phelps Montgomery, Mt. Carmel.
Description—Stalk medium in height. Kernels white. Does not mature at Storrs.
History—Unknown.

Variety—White Cap Yellow Dent.
Source—N. S. Strong, North Plain.
Description—Stalk medium in height, small in diameter. Ear short and small. Kernels yellow with white caps, medium in depth and size, 12-16 rows. Matures very well at Storrs.
History—Grown in North Plain for 45 years.

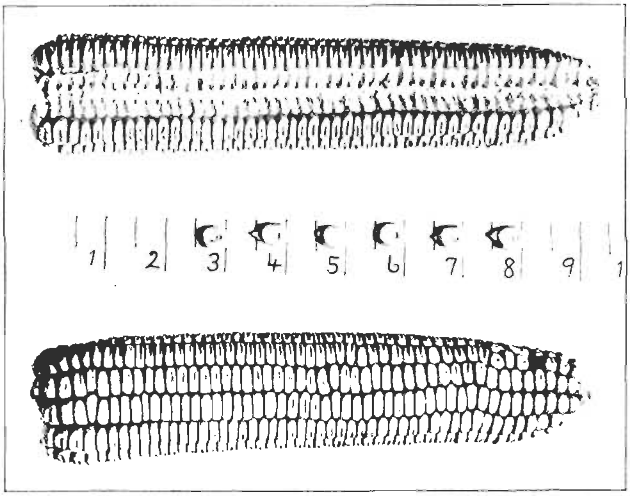

Figure 78.

Variety—Northern White Dent.
Source—B. W. Bishop, Guilford.
Description—Stalk tall and large. Ear long and large. Kernels white, medium in depth, very large, 12 rows. Does not mature at Storrs.
History—Mr. Bishop obtained seed from Peter Henderson Company, New York City about 1905, and grew it near White Hickory King, with which it probably mixed.

Variety—Peck's Yellow Dent.
Source—W. O. Peck, East Haddam.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels yellow, medium in depth and size, 14-18 rows. Matures well at Storrs.
History—Mr. Peck obtained seed of a "Connecticut Leaming" in 1916. May be slightly mixed with Brewer's Dent and also with Luce's Favorite.

DENT VARIETIES—*Continued.*

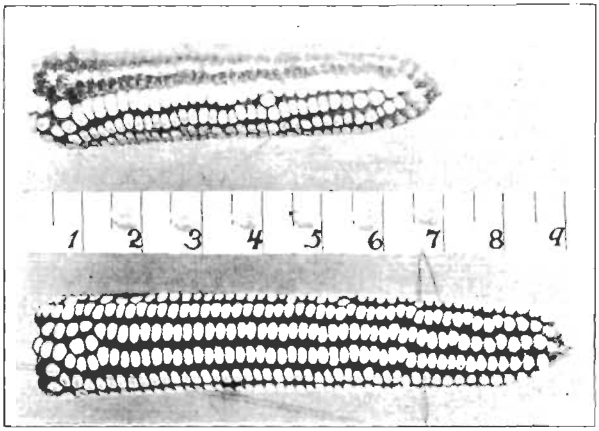

Figure 79.

Variety—Pride of the North.
Source—Storrs Agric. Exper. Station.
Description—Stalk short and small. Ear medium in length and diameter. Kernels yellow, mediumly deep and small, 12-18 rows. Matures well at Storrs.
History—Improved and selected by the late Professor A. G. Gulley of the Connecticut Agricultural College, originally obtained from Ithaca, New York. Grown at Storrs about 15 years.

Variety—Pride of North.
Source—I. N. Hollister, Glastonbury.
Description—Stalk short and small. Ear medium in length. Kernels a variable yellow, 14-16 rows. Matures well at Storrs.
History—Unknown.

Variety—Pride of North.
Source—S. W. and F. A. Kirk, Hamden.
Description—Stalk short and small. Ear short and small. Kernels yellow, medium in depth, small, 16-18 rows. Matures very well at Storrs. Smaller than Storrs' Pride of North.
History—Messrs. Kirk obtained seed from the late Professor Gulley of Storrs in 1910 and have selected since for maximum number of rows of kernels and mature and well filled ears.

Variety—Pride of North.
Source—H. J. Larkham, Norwichtown.
Description—Stalk short and small. Ear medium in length and diameter. Kernels yellow, medium in depth and size, 12-14 rows. Matures well at Storrs.
History—Seed obtained from Thomas Griswold Seed Co., South Wethersfield, Conn.

Variety—Red Cob.
Source—Platt Seed Co., New Haven.
Description—Stalk tall and large. Kernels white. Does not mature at Storrs.
History—Seed obtained from Missouri.

DENT VARIETIES—*Continued.*

Variety—Reynolds Yellow Dent.
Source—W. W. Reynolds, New Britain.
Description—Stalk medium in height and diameter. Ear medium in length, large. Kernels yellow, deep, medium size, 14-16 rows. Matures at Storrs in favorable seasons.
History—Unknown.

Variety—Sciota.
Source—B. F. Page, Durham.
Description—Stalk short and small. Ear medium in length, small. Kernels yellow with white caps, 12-14 rows. Matures well at Storrs.
History—Obtained seed from Ohio about 40 years ago.

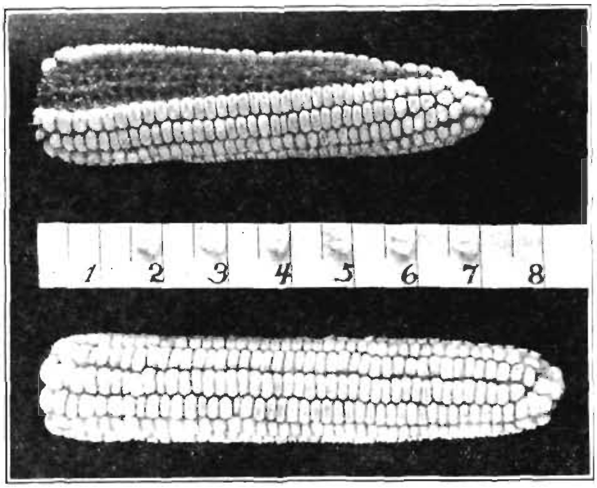

Figure 80.

Variety—Sharon White Cap.
Source—E. K. Dean, Sharon.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels yellow with white caps, medium in depth and size, 12-14 rows, Matures well at Storrs.
History—Brought by C. E. Benton from Michigan about 40 years ago. Generally grown about Sharon.

Variety—Silver King.
Source—Roy McDonald, Menomonie, Wis.
Description—Stalk short and small. Ear short, medium in diameter. Kernels white, deep, small, 16 rows. Matures very well at Storrs.
History—Obtained from Iowa by Wisconsin Experiment Station in 1904 and adapted by ear-to-row selection. Grown at Menomonie about 10 years, selecting the best ears in the field.

Variety—Sutton's Dent.
Source—R. C. Wilcox & Sons, Guilford.
Description—Stalk medium in height and large in diameter. Ear medium in length, very large. Kernels light yellow, deep, large, 14-16 rows. Does not mature very well at Storrs.
History—Obtained from Sutton Seed Co., in Illinois.

DENT VARIETIES—*Continued.*

Variety—Sweepstakes.
Source—S. L. Hollister, Washington.
Description—Stalk tall, medium diameter. Ear medium in length and diameter. Kernels yellow, medium in depth and size, 14-18 rows. Does not mature very well at Storrs.
History—See West Branch Sweepstakes.

Variety—Sweepstakes.
Source—Alex Smith, Clintonville.
Description—Stalk medium in height and diameter. Ear medium in length, large. Kernels reddish yellow, medium in depth, large, 12-18 rows. Does not mature very well at Storrs.
History—Is a result of a cross made 15-20 years ago between "Lancaster Sure Crop" and a local Pennsylvanian variety. Has been selected since.

Variety—Sweepstakes.
Source—West Branch Seed Growers' Association, Williamsport, Pa.
Description—Stalk medium in height and large in diameter. Ear medium in length and very large. Kernels a variable yellow, mediumly deep, large, 12-20 rows. Does not mature well at Storrs.
History—Is a result of a cross made 15-20 years ago between "Lancaster Sure Crop" and a local Pennsylvanian variety. Has been selected since.

Variety—Sweepstakes.
Source—Clark Seed Company, Milford.
Description—Similar to West Branch Sweepstakes.

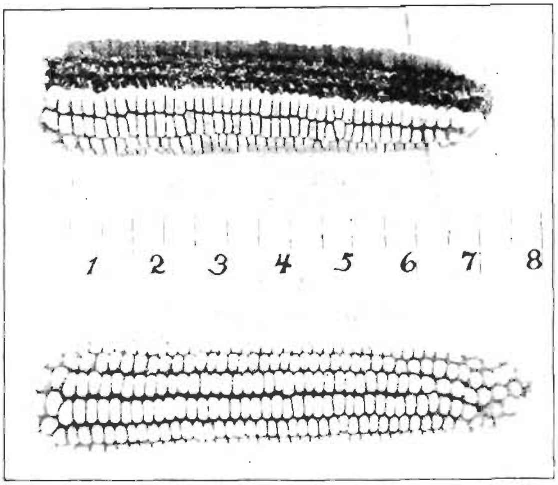

Figure 81.

Variety—Tryon Dent.
Source—J. E. Daniels, Middletown.
Description—Stalk medium in height and small in diameter. Ear medium in length, tapering slightly. Kernels yellow, 12-16 rows. Matures well at Storrs.
History—Originally Dowd Dent. Brought to Middletown from Guilford about 1900 by Willis Tryon and has been grown there since by a few farmers.

DENT VARIETIES—*Continued.*

Variety—U. S. Department of Agriculture No. 119.
Source—Office of Cereal Investigations, Bureau of Plant Industry, Washington, D. C.
Description—Stalk tall and very large. Ear medium in length, very large. Kernels white, deep, large, 14-20 rows. Does not mature at Storrs.
History—A selection from Boone County White, obtained from Marley Riley, Thorntown, Boone County, Indiana. Bred by the U. S. Department of Agriculture since 1903 around Washington, D. C. Boone County White was originated by James Riley, Thorntown, Ind., in 1880.

Variety—U. S. Department of Agriculture No. 125.
Source—Office of Cereal Investigations, Bureau of Plant Industry, Washington, D. C.
Description—Stalk medium in height and large in diameter. Ear medium in length, large in diameter. Kernels yellow, deep, medium in size, 16-20 rows. Matures in very favorable seasons at Storrs.
History—A selection from Clarage, secured from Theodore Giffin at Sabina, Ohio in 1901. Grown and bred by the U. S. Departemnt of Agriculture at Sabina as Sel. 78 from 1901 to 1904. Grown as Sel. 125 at Sunbury, Ohio, 1905 to 1915. For a complete history of Clarage see Ohio Station Circular No. 117, "Varieties of Corn in Ohio."

Variety—U. S. Department of Agriculture No. 133.
Source—Office of Cereal Investigations, Bureau of Plant Industry, Washington.
Description—Stalk short and small. Ear medium in length, large. Kernels yellow, deep, medium in size, 14-18 rows. Matures very well at Storrs.
History—A selection from Minnesota No. 13. Secured from Professor C. P. Bull, Minnesota Experiment Station in 1903. Bred and improved by the Minnesota Experiment Station since 1893. Bred by U. S. Department of Agriculture from 1904 to 1921 at Hartford, South Dakota, and Oconomowoc, Wis.

Variety—Webber's Dent.
Source—Department of Plant Breeding, Cornell University, Ithaca, N. Y.
Description—Stalk medium in height, small in diameter. Ear short and small. Kernels yellow, shallow, small, 14-16 rows. Matures very well at Storrs.
History—Developed at Cornell Experiment Station by 5 years of ear-to-row selection from Funk's 90 Day in co-operation with G. R. Schauber of Ballston Lake, Saratoga Co., New York.

Variety—Webber's Dent.
Source—Willis Frost, Bridgewater.
Description—Stalk medium in height and diameter. Ear medium in length and diameter, tapering slightly. Kernels yellow, deep medium in size, 14-18 rows. Matures fairly well at Storrs.
History—Developed at Cornell Experiment Station by 5 years of ear-to-row selection from Funk's 90 Day in cooperation with G. R. Schauber of Ballston Lake, Saratoga Co., New York. Seed obtained in 1916.

DENT VARIETIES—*Continued.*

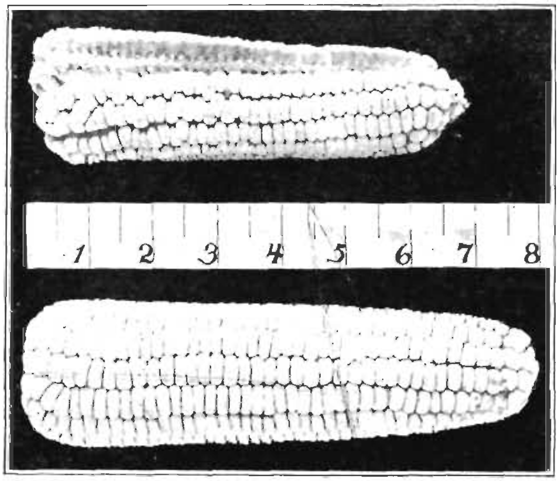

Figure 82.

Variety—White Cap.
Source—G. D. Hall, Wallingford.
Description—Stalk medium in height and diameter. Ear short and tapering. Kernels yellow with white caps, 12-16 rows. Matures at Storrs.
History—Known as Tyler's White Cap and grown around Wallingford for at least 40 years.

Variety—White Cap.
Source—W. F. Herr, Brooklyn.
Description—Stalk medium in height and diameter. Ear medium in length, large in diameter. Kernels yellow with white caps, medium in depth, large, 14 rows. Matures at Storrs.
History—Unknown.

Variety—White Cap.
Source—L. C. Root & Son, Farmington.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels yellow with white caps, medium in depth and size, 14-16 rows. Matures at Storrs.
History—Obtained from Mr. Kelsey in West Hartford about 1910. Originally from Chas E. Lyman, Middlefield, Conn. Grows alternately on Mountain land and low land.

Variety—White Cap.
Source—Joseph Whathley, Kent.
Description—Stalk short and small. Ear medium in length. Kernels yellow with white caps, 12-14 rows. Matures well at Storrs.
History—Unknown.

DENT VARIETIES—*Concluded.*

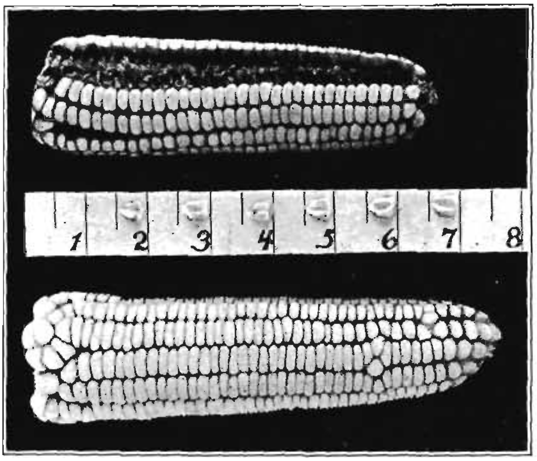

Figure 83.

Variety—White Cap.
Source—Henry Squires, New Milford.
Description—Stalk medium in height and small in diameter. Ear short, small, slightly tapering. Kernels yellow with white caps, 12-14 rows. Matures very well at Storrs.
History—Mr. Squires obtained seed from Sharon 12-15 years ago.

Variety—White Cap.
Source—West Branch Seed Growers' Association, Williamsport, Pa.
Description—Stalk medium in height, large in diameter. Ear long, and large. Kernels yellow with white caps, deep, large, 16-20 rows. Matures at Storrs in favorable seasons.
History—Grown in Pennsylvania for many years.

Variety—Woodford's Dent.
Source—G. C. Woodford, Plainville.
Description—Stalk medium in height and diameter. Ear medium in length and diameter. Kernels deep yellow, medium in depth and size, 16-20 rows. Matures fairly well at Storrs.
History—This variety is the result of crossing Early Lakeside on a local dent. Mr. Woodford makes the cross each year.

BULLETIN 260 NOVEMBER, 1924

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

Rust Infection of Leaves in Petri Dishes

G. P. CLINTON
and
FLORENCE A. McCORMICK

BOTANICAL DEPARTMENT

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

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a. II stage of *Phragmidium Potentillae* on *Potentilla canadensis*, Inf. No. 101 Ia II.

b. III stage of *Gymnoconia interstitialis* on *Rubus villosus*, Inf. No. 959.

c. O stage of *Gymnosporangium Juniperi-virginianae* on *Pyrus Malus*, Inf. No. 937.

d. II stage of *Cronartium ribicola* on *Ribes vulgare*, Inf. No. 764.

ARTIFICIAL INFECTIONS OF RUSTS IN PETRI DISHES.

Rust Infection of Leaves in Petri Dishes.*

G. P. Clinton and Florence A. McCormick.

HISTORICAL.

On May 21, 1918, the writers placed aeciospores (Inf. No. 298), of *Cronartium ribicola* from *Pinus Strobus* on leaves of *Ribes nigrum* in a Petri dish in the hope of determining the method by which the germ tubes entered the leaves. Within twenty-four hours it was found that they had gained entrance into the leaves through the stomates and the dish was set aside for later examination to see if further development took place. About ten days after inoculation examination showed, much to our delight, numerous mature uredinia. Similar inoculations made a day or two later showed about this time even more abundant infections, in fact better than those obtained on living plants.

These results encouraged us in the belief that this method of inoculation might possess advantages superior to that with living plants in the greenhouse; consequently more inoculations were made on a variety of *Ribes* leaves in Petri dishes. Fair success attended these experiments although the inoculating material used was not very good. Improvement of the methods used and comparison of Petri dish versus pot infections, made under similar conditions and at various times, finally led us to the conclusion that the Petri dish method gave results on the whole equal to the pot method and had several distinct advantages in simplicity of operation.

Literature. The writers made brief mention of this method in Bull. 2, White Pine Blister Rust Control, p. 14, published by the American Plant Pest Committee in 1918 and in publications of this Station (Bull. 214, pp. 437, 440, and Bull. 222, p. 471.) in 1919 and 1920.

So far as we know no other writers have published statements concerning successful production of rust sori on leaves in Petri dishes, though somewhat similar experiments have been published by various workers. For instance Farlow (American Acad. Arts & Sci. **20**: 311.) in 1885, working with five species of *Gymnosporangium*, produced pycnia on detached leaves of *Crataegus* and *Amelanchier* with three of the species under the conditions quoted as follows: "The leaves (Pomaceæ) were placed on moistened glass slides and arranged on zinc stands under bell-glasses. The sporidia

* This paper was largely written in the spring of 1921 when other work prevented its completion. It has now been brought up to date including the inoculations made since then. We are indebted to E. M. Stoddard of this department for the photographs used.

were then carefully dropped upon the leaves, which were immediately covered by a bell-glass. The leaves under each glass were sown with the sporidia of but one species, the bell-glasses were removed for a moment only, and at no time were the leaves under more than one bell-glass exposed. I also used a number of small seedlings of Pomaceæ, each pot being covered by a glass receiver."

Ward (Proc. Roy. Soc. Lond. **69**: 451.) in 1902 described a unique method for growing grass seedlings in large special test tubes where pure cultures of rusts were grown on them while thus protected. His method is best described by the following extracts from his paper: "In order to obtain more decisive answers to such questions as—Are any of the results obtained on plants in the open or merely covered with bell-jars and so forth, due to spores accidentally introduced, or to mycelium, etc., already in the plant? —a number of infections were made on seedlings germinated and grown antiseptically in tubes as follows * * * * Clean picked seeds were placed singly, by means of forceps, on filter paper at the bottom of Petri dishes properly sterilized by heat. When these had germinated and observation showed that the whole series was free of moulds or other signs of contaminations, the seedlings were removed by means of sterile forceps, and transplanted singly into sterilized tubes of various kinds as described below, and the further growth allowed to proceed in the light under conditions varied as will be seen * * * * Preliminary experiments soon showed that the Brome seedlings thus raised from seeds treated antiseptically and protected from the first by glass, may be grown for weeks and even for a couple of months in such tubes under proper precautions, and I set myself the task of ascertaining how such cultures would behave in infection experiments. * * * * This experiment is interesting not only as showing that plants can be grown and infected successfully in these closed water-cultures, but especially as showing the contrast between the aerated and non-aerated tubes, for since the infected seedlings were selected in each case from the same Petri dish cultures, we must assume that the difference in rate of development was due to the difference of ventilation, and perhaps conclude that this interferes with the success of the parasite, as measured by the somewhat longer inoculation period. It is remarkable how dwarfed the continuously aerated plants are, compared with those in the closed tubes, owing to the elongation of the leaves of the latter. It is clear, therefore, that pure cultures of Uredo-spores can be obtained by this method, and it is equally clear that we can also obtain pure cultures of the host-plants, and since we can do this, there is no reason why the infection of Uredineae should not be conducted as vigorously and exactly as that of bacteria."

Coons (Ann. Rep. Agr. Exp. Sta. Neb. **25**: 222.) in 1912 made inoculations in Petri dishes with *Gymnosporangium Juniperi-*

virginianae on apple leaves to determine the method of entrance of the germ tubes. Evidently he did not save the inoculations long enough to observe further development. We make the following quotation from his article: "With the microscope it was possible to see the hyphae from the sporidia after a vagrant tortuous growth in the water, bend sharply downward at the edge of the drop and pass into the cells beneath. This last observation was made with leaves washed in sterile water and kept in Petri dishes. These were inoculated in drops of water and marked by circles with the cork borer."

The Petri dish method of infection with fungi other than rusts has been tried by various experimenters as shown by the two following references. Salmon (Journ. Bot. **41**: 212.) in 1903 described his methods with the powdery mildews in these words: "The following method of culture for infection experiments has been adopted. The leaves to be inoculated are cut off from the plant and placed on wet filter paper at the bottom of a Petri dish, the under surface of the leaf being everywhere pressed into contact with the wet filter-paper. If the experiment is to be continued for more than a week or ten days, a seedling with the first leaf attached to the seed must be used. The Petri dishes can be placed in circular dishes of about the same depth and of a half-inch greater diameter and the intervening space at the sides stuffed with cotton-wool. This will remove all danger of infection from foreign spores after the experiment has been set up."

In 1916 very similar methods were used by Blackman and Welsford (Ann. Bot. **30**: 390.) in infection work with *Botrytis cinerea* described as follows: "Before infection the leaves are washed with a gentle stream of sterile distilled water to remove as far as possible extraneous spores and dust. They are then placed on damp filter-paper on a sterile Petri dish, and drops of the prepared solution containing spores placed on their upper surfaces."

The writers were not aware of the methods of the preceding investigators when their work was first undertaken. The results we obtained, however, with *Cronartium ribicola* were such as to justify us in extending the experiments to various other rusts. These experiments have now been carried on over seven seasons. The number of hosts thus infected with various species has exceeded our expectations. The improvement of our methods through experience enabled us to keep leaves alive much longer than at first and thereby successful inoculation was increased. It is deemed advisable to make a more detailed record here of our methods, with the results obtained, in order that they may be used by others, since our experience has shown decided advantages with this method especially with rusts which inhabit the less succulent and ephemeral leaves.

METHODS.

Petri dish versus pot method. Soon after finding that successful inoculation of *Ribes nigrum* could be made in Petri dishes with blister rust, it was decided to carry on a series of tests with different species of *Ribes* in Petri dishes as well as in pots. Tests were made with both I and II stages. In Table I is given a summary of all our experiments with these stages in Petri dishes and pots, regardless of whether they were made under similar conditions or not. This shows that with the I stage out of one hundred and seventy tests made in Petri dishes 66% were successful and according to our grade of marking these were rated poor (+), while of the one hundred and twenty-three tests made in pots 78% were successful with an average of fair (−). These tests favor somewhat the pot method, especially as regards percentage of infection. In this case it is to be remembered, however, that many more leaves were exposed to infection. In the tests with the II stage, where the amount of uredospores and number of leaves inoculated were more nearly alike, because of the difficulty of obtaining an abundance of the spores, the results were about the same. In this case in one hundred and sixty-nine tests in Petri dishes 57% were successful with an average rating of poor (+), while of the fifty-six tests in the pots 57% were successful with an average rating of fair (−).

Several comparative tests were made with the I stage on leaves in Petri dishes and plants in pots, with the other conditions as nearly alike as possible, on twenty-four species and varieties of *Ribes*. While these gave somewhat different results on certain of the hosts, sometimes in favor of the Petri dish and again in favor of the pot, the average result for the lot was about the same from each method, favoring slightly the pot. We concluded at the time, taking into consideration the amount of inoculating material and the number of leaves used, that one method was as successful as the other. We were not able to make similar comparisons with other rusts but our general experience with those inhabiting leaves of shrubs and trees is that the Petri dish method has certain advantages.

Technique. Where a considerable number of inoculations is to be made, Petri dishes of about 100 mm. in diameter and 15 mm. deep are a convenient size to use. A larger size is even more desirable, especially when few are required. Our usual method has been to stretch two well-washed rubber bands loosely across the bottom of the sterilized dish, and on these is placed the wet leaf or leaves. When the cover is inserted the leaves should be near the top but not touching it. Our most recent method has been to file four opposite or equally distant notches, about a quarter of an inch deep, in the edge of the bottom dish and stretch the rubber bands across and diagonally through these to hold the

leaves out of the water below but free from pressure above. (See Plate XXVIa.) Glass rods with a flat surface below can be used in place of the rubber bands. These, however, should be of sufficient height to elevate the leaf above the water and near to the cover. A small amount of water is poured in the bottom of the dish. The spores are dusted or brushed off the inoculating material over the exposed surface of the leaf. In case the I and II stages are used it is better to place the lower surface of the leaf uppermost, since infection usually takes place through the stomates which are more abundant on that surface; also the sori that result in such cases usually break out on the lower surface and consequently can be watched carefully without disturbing the leaf or removing the cover. In case the inoculation is with the III stage, where infection generally takes place by direct penetration of the epidermis, it is better to place the upper surface of the leaf uppermost, as this is freer from hairs which hinder infection. Furthermore the pycnial stage is more likely to appear on this surface and it is difficult to carry the infection beyond this stage because of the length of time required. The Petri dish should be placed where it receives direct light favorable for plant growth. North light or direct sunlight partially screened by thin white paper or a coating on the windows is desirable. The conditions upon which infection is successful depend largely upon the following factors—leaves, moisture, light and heat.

Leaves. The leaves must remain in fairly healthy condition from seven to ten days and in some cases more than two weeks after inoculation. Leaves of different plants vary greatly in this respect. As a rule the hardier leaves of shrubs and trees do not succumb as quickly as those of herbaceous plants. Again with some plants, as the grasses, it is often impossible to place the whole leaf in the Petri dish because of its size and mutilation is more or less harmful. Enzymatic or other changes in certain leaves frequently kill them before infection is apparent, but the chief difficulty seems to be with molds that cause decay. This last injury can be reduced or delayed by very thorough washing of both sides of the leaves in running tap water. The wet leaf is then placed in the Petri dish. Partial sterilization did not give so effective results as the washing in water alone. This is a matter, however, that may need further investigation. It is taken for granted that in the selection of leaves only those in the best condition, and, where possible, of a size smaller than the Petri dish will be selected; also that they are free from natural infection.

Moisture. The moisture in the bottom of the Petri dish is sufficient to keep the air fairly well saturated. Considerable moisture becomes condensed on the cover in close proximity to the inoculated surface of the leaf, thereby making conditions for spore germination very favorable. It is necessary from time to time to renew the water in the bottom of the dish as it is lost by

evaporation. This may be added by pouring it in the dish or by spraying it over the leaves, as conditions warrant. The dish should never be allowed to become entirely dry as the leaves will wither and die in a very short time. On the other hand the amount of water should not be sufficient to touch the leaf blade in the handling that is necessary. In our work different methods were tried, such as a small film or an abundance of water with the leaf directly on it. The method described, however, seemed to possess the most merits in securing abundance of infection and freedom from molds.

Light. In the first experiments the Petri dishes were left in the diffused light of the culture room some distance from the window. Trouble with molds suggested that better results might be obtained with direct light. Comparative tests were then made both with inoculated and uninoculated leaves left in the culture room and others placed in the small laboratory greenhouse having an eastern exposure but with the light cut off from the south and west. To lessen the strong sunlight of summer the glass was shaded by paper. These tests were in favor of the direct light so that practically all of our infections have been made in this greenhouse. Our opinion is that the latter place is more favorable for the following reasons. First, the direct light on the leaves seems to keep them in healthier condition so that molds are not so troublesome as in subdued light. Second, this action on the chloroplasts favors the normal photosynthetic processes which furnish food for the leaf and thereby favor the more vigorous development of the fungus. If it were not for the ease of examination, etc., it would probably be better in all cases to expose the upper surface of the leaf to the light thereby securing full benefit from it as in nature.

It is surprising how long some leaves remain healthy under these optimum conditions. Not infrequently we have kept leaves green and alive for three or four weeks. In exceptional cases where a callus has formed at the base of the petiole, they have remained alive even longer. In one case a *Rubus* leaf, where a callus had formed and rootlets developed, remained alive for a couple of months. Plate XXVIb shows a black currant leaf about a month after it was placed in a Petri dish developing a secondary callus at one side of the primary one. This leaf was just beginning to die when photographed. Plate XXVId shows one of several leaves of *Solidago rugosa* that remained alive and green three months in the Petri dishes developing from the calluses formed at their bases branched rootlets one to two times the length of the leaves. These leaves were then placed in sand and later earth added in the hope that they might develop buds and new plants and were still healthy and green after four months. Either the addition of the earth or accidental drying out caused their death soon afterward. However, one had formed a minute plantlet on a root or runner de-

veloped from the callus. These examples are, of course, exceptional but in case a callus develops longer life is assured. Whether coating the end of the petiole with melted paraffin would favor callus formation has not been determined.

Heat. It has been shown with the rusts, as with other fungi, that spores germinate best at certain temperatures known as their optimum and that maximum temperatures also exist beyond which germination ceases to take place. Doran (Phytopath. **9**: 391–402. S. 1919.) worked with several of the rusts along this line and he found that for the aeciospores of *Cronartium ribicola* the optimum temperature was 12°C and the maximum 19°C and the uredospores had an optimum temperature of two degrees and a maximum of six degrees higher than those of the aeciospores. In our experiments the ordinary room temperature of the greenhouse in spring and fall seemed favorable. In mid-summer, however, the temperature reached such a height that practically all the cultures died out. To obviate this difficulty a modification of Hunt's (Phytopath. **9**: 211–12. My. 1919.) iceless refrigerator was used. This on the whole kept the temperature down on an average only a few degrees, but it was sufficient to favor the cultures over those outside. However, the cloth cut down the light so that this was not so favorable. A cold incubator with glass sides which can be kept in the sunlight at a desired temperature would be a very valuable adjunct for summer inoculations.

GENERAL RESULTS.

Advantages and disadvantages of method. We will first mention the one disadvantage of the Petri dish method, the early death of the leaves. This happens more quickly with some leaves than with others as has already been mentioned. With *Cronartium ribicola* on *Ribes* it was only an occasional disadvantage as most of the leaves lived long enough to produce mature sori of uredinial and occasionally of telial stages. With such tender leaves as clovers, however, death of the leaves often occurred too early to secure definite results. With *Pyrus* the leaves usually lived long enough to secure pycnia but not long enough to produce aecia. A combination of this method with Ward's, using the latter for grasses and quick growing seedlings, will probably solve the problem for infection of most hosts. No doubt some may be disappointed with their first results of the Petri dish method, as experience is an important factor in obtaining success.

The advantages must be evident to anyone who stops to consider the matter. First, we mention compactness. Petri dishes occupy little space and by means of glass or wire shelves many can be used in a small area. Ordinarily we have used them on glass shelves in the iceless refrigerator or on a cement greenhouse bench containing sand which has been covered with botanical driers soaked in corrosive sublimate to prevent molding. The

second advantage is economy of material. Often one plant will furnish enough leaves for many experiments whereas if the pot method is used the whole plant is involved. A third advantage is ease and exactness of observation. With a leafy plant of some size the first appearance of the sori may escape observation. These can be observed through the Petri dish cover very easily and quickly. By this method we have found uredinial sori within six days and twenty-two hours after inoculation. This is earlier than we have ever found them on plants in pots. A fourth advantage is the surety of pure cultures since there is little danger, compared with plants in pots, of spores of other rusts reaching the inoculated leaves. Better control of moisture for securing germination of spores is another advantage.

Rusts used in the experiments. Altogether thirteen different genera of rusts were experimented with, as follows: *Caeoma*, *Coleosporium*, *Cronartium*, *Gymnoconia*, *Gymnosporangium*, *Kuehneola*, *Melampsora*, *Melampsoridium*, *Melampsoropsis*, *Phragmidium*, *Puccinia*, *Pucciniastrum* and *Uromyces*. We were successful in producing one or more infections with all of these excepting the first. Under these genera forty-five different species were used and successful inoculations were secured with all but seventeen. Many different hosts were inoculated with these. Some of these failures were due to the use of the wrong host. In other cases failure was due to poor inoculating material. It is quite probable that in some tests the leaves died before the sori had time to develop. The most extended experiments were with *Cronartium ribicola* involving three hundred and thirty-nine tests on thirty-eight different species and varieties. Tests were made with all spore stages, O, I, II and III. No results were obtained with the O stage, as was to be expected. Most inoculations were made with the I and II stages. No new relationships between supposedly distinct species were found. Several new hosts, however, were secured through inoculations and a few old hosts are reported for the first time experimentally.

In interpreting the results of the inoculations we have used the following terms: failed, poor, fair, good and excellent. These, except the first, have been used in a general rather than in an exact sense. Usually the number of sori occurring has indicated the class. With the pot experiments, however, the number of infected leaves as well as the number of sori was taken into consideration. The amount of inoculating material used, especially the II stage, was also a factor in grading. As a rule poor indicates that fewer than five sori developed. Excellent implies the development of forty or more on a leaf or leaves in a Petri dish and an even greater total number on the leaves of a plant in a pot. Good and fair are intermediate terms. The inoculation number and date, as well as source of inoculating material and host inoculated, are given with each experiment. The details of the experiments

DETAILS OF INOCULATIONS AND INFECTIONS.

Caeoma nitens Schw.

None of the inoculations made with this short cycled form was successful. Comparison should be made with similar successful inoculations with the long cycled form given here under *Gymnoconia interstitialis.* We thought at one time that possibly this short cycled form was the *Caeoma* stage of some other rust, most likely *Melampsora*, but our failures to inoculate the various species of *Populus, Salix* and *Betula* discredit this supposition. Likewise the failure to inoculate mature leaves of *Rubus* species has led us finally to believe that infection takes place with this short cycled form only through the young tissues especially the underground shoots. See articles in Bull. 222, p. 469, of this Station.

O stage from *Rubus villosus* (*R. canadensis*): on *R. villosus*, 894 (upper surface), 895 (lower surface), 896 (cut surface), My. 27, '19, failed.

I stage from *Rubus allegheniensis* (*R. villosus*): on *R. allegheniensis*, 1349 (wild), 1353 (Erie), 1355 (Snyder), Je. 22, '20, failed: on *R. villosus*, 1347, Je. 22, '20, failed: on *R. occidentalis*, 1345, 1351, Je. 22, '20, failed.

I stage from *Rubus villosus:* on *Betula lenta*, 904, 911, 918, My. 27, '19, failed: on *B. populifolia*, 903, 910, 917, My. 27, '19, failed: on *Populus deltoides*, 907, 914, 921, My. 27, '19, failed: on *P. grandidentata*, 901, 908, 915, My. 27, '19, failed: on *P. tremuloides*, 902, 909, 916, My. 27, '19, failed: on *Populus* sp., 363, Je. 22, '18, failed: on *Rubus hispidus*, 4336, Je. 15, '23, failed; 4351, Je. 20, '23, failed: on *R. villosus*, 332, 333, 334, 335, Je. 6, '18, failed; 958, Je. 11, '19, failed; 4004, Je. 15, '22, failed; 4289, 4292, Je. 1, '23, failed; 4327, Je. 12, '23, failed; 4337, Je. 15, '23, failed; 4344, Je. 16, '23, failed; 4349, Je. 20, '23, failed; 4579, 4582, Jl. 2, '24, failed: on *Rubus* sp. (cult. blackberry), 4007, Je. 15, '22, failed; 4288, 4291, Je. 1, '23, failed; 4328, Je. 12, '23, failed; 4350, Je. 20, '23, failed; on *Rubus* sps., (wild and cult. raspberry), 4005, 4006, Je. 15, '22, failed; 4290, 4293, Je. 1, '23, failed: on *Salix* sps., 905, 906, 912, 913, 919, 920, My. 27, '19, failed.

Coleosporium delicatulum (Arth. & Kern) Hedgc. & Long.

The successful inoculation, on *Solidago graminifolia Nuttallii*, was with the host on which the II and III stages of this rust most commonly occur in this state. The senior writer in years previous had also inoculated the same host in crock experiments. One out of four inoculations was successful as follows:

I stage from *Pinus rigida:* on *Aster* sps., 807, 808, My. 19, '19, failed: on *Solidago graminifolia Nuttallii*, 814, My. 20, '19, fair, II: on *S. rugosa*, 806, My. 19, '19, failed.

Coleosporium Solidaginis (Schw.) Thuem.

Inoculations of the I stage from *Pinus rigida* were successful on *Solidago rugosa, S. sempervirens*, and of the II stage from *Solidago* sp. on *Solidago* sp. and *S. rugosa*. Five out of twelve inoculations, or 42%, were successful as follows:

I stage from *Pinus rigida:* on *Solidago rugosa*, 933, Je. 4, '19, good, II; 1344, Je. 17, '20, excellent, II; 4568, Je. 11, '24, poor, II: on *Solidago sempervirens*, 893, My. 26, '19, poor, II.

II stage from *Solidago rugosa:* on *Aster laevis*, 579, O. 5, '18, failed: on *Solidago rugosa*, 578, O. 5, '18, failed; 1115, O. 27, '19, failed.

II stage from *Solidago* sp.: on *Aster laevis*, 1021, Jl. 19, '19, failed: on *Aster* sp., 1522, O. 28, '20, failed: on *Solidago graminifolia Nuttallii*, 1019, Jl. 19, '19, failed: on *S. rugosa*, 1020, Jl. 19, '19, failed; 1521, O. 28, '20, poor, II: on *Solidago* sp., 1022, Jl. 19, '19, fair, II.

Cronartium Comptoniae Arth.

Successful inoculations on *Myrica asplenifolia* were made with the I stage from the five species of *Pinus* tried. The inoculations with the III stage on the pines probably failed, at least nothing definite showed to the naked eye. Our inoculations of plants in crocks, however, showed that there is very little visible sign of successful inoculation. At one time the *Cronartiums* were classed together under *C. asclepiadeum* but our unsuccessful attempts to inoculate *Ribes* and *Quercus* add weight to the belief that the rusts on these two hosts and *Myrica* are distinct species as now regarded. The details of the inoculations follow:

I stage from *Pinus austriaca:* on *Myrica* (*Comptonia*) *asplenifolia*, 4556, My. 28, '24, excellent, II.

I stage from *Pinus montana Mugho:* on *Myrica asplenifolia*, 4285, My. 31, '23, excellent, II; 4566, Je. 10, '24, excellent, II. See Plate XXVIa.

I stage from *Pinus ponderosa:* on *Myrica asplenifolia*, 4286, My. 31, '23, excellent, II.

I stage from *Pinus rigida:* on *Myrica asplenifolia*, 342, Je. 6, '18, good, II: on *Ribes nigrum*, 899, My. 27, '19, failed.

I stage from *Pinus sylvestris:* on *Myrica asplenifolia*, 340, Je. 6, '18, good, II: on *Ribes nigrum*, 302, My. 27, '18, failed: on *R. vulgare*, 301, My. 27, '18, failed: on *Quercus alba*, 341, Je. 6., '18, failed.

III stage from *Myrica asplenifolia:* on *Pinus austriaca*, 1079, S. 15, '19, (?) failed: on *P. sylvestris*, 1078, S. 15, '19, (?) failed.

Cronartium occidentale Hedgc., Beth. & Hunt.

The inoculations with the I stage from *Pinus monophylla* were all made on May 28, 1920 and were successful on the following hosts: *Ribes americanum*, *R. aureum*, *R. aureum chrysococcum*, *R. Cynosbati*, *R. divaricatum*, *R. Grossularia* (*uva-crispa*), *R. hirtellum*, *R. intermedium*, *R. nigrum*, *R. nigrum aconitifolium*, *R. odoratum*, *R. oxyacanthoides*, *R. robustum*, and *Ribes* sps. (cult. gooseberries). Several were apparently new hosts for this rust. The inoculations were in triplicate, the average results being given. We are indebted to Bethel and others of the U. S. Department of Agriculture for the inoculating material used.

I stage from *Pinus monophylla:* on *Ribes alpestre*, 1270, failed: on *R, alpinum* ♂, 1285, failed: on *R. americanum*, 1273, poor, II, III: on *R. aureum*, 1267, good, II, III: on *R. caucasicum*, 1269, failed: on *R. aureum chrysococcum*, 1276, excellent, II: on *R. curvatum*, 1271, failed: on *R. Cynosbati*, 1275, good, II, III: on *R. divaricatum*, 1272, fair, II:

on *R. Grossularia (uva-crispa)*, 1289, fair, II, III: on *R. giraldii*, 1268, failed: on *R. hirtellum*, 1281, fair, II: on *R. holosericeum*, 1284, failed: on *R. intermedium*, 1278, fair, III: on *R. luridum*, 1280, failed: on *R. nigrum*, 1279, poor, II: on *R. nigrum aconitifolium*, 1287, poor, II: on *R. odoratum*, 1290, good, II: on *R. oxyacanthoides*, 1291, good, II, III: on *R. robustum*, 1277, poor, II: on *R. stenocarpum*, 1288, failed: on *R. vulgare* (Fay's Prolific), 1274, failed; 1283 (small currant), failed; 1282, (white currant), failed: *Ribes* sps. (large cult. gooseberry), 1286, poor, II; 1292 (Smith's small gooseberry), poor, II, III.

II stage from *Ribes aureum chrysococcum* (in Petri dish): on *Ribes aureum chrysococcum*, 1276 (2), Je. 17, '20, failed.

II, stage from *Ribes gracillimum*: on *R. americanum*, 4403, Jl. 14, '23, failed: on *R. aureum*, 4404, Jl. 14, '23, failed: on *R. nigrum*, 4402, Jl. 14, '23, failed.

Cronartium ribicola Fisch. de Waldh.

Inoculations with I stage from *Pinus Strobus*. In the experiments with the I stage thirty-eight species and varieties of *Ribes* were used and one hundred and seventy-two inoculations made. Of these one hundred and six, or 62%, were successful, despite using old spores and inoculating the upper surface in a number of cases. *Ribes nigrum*, with twenty-seven tests of which nearly 78% produced infection, and *Ribes oxyacanthoides*, with eight inoculations and 87% of infection, gave the best results. The following species also became infected: *R. alpinum* ♀, *R. americanum*, *R. aureum*, *R. aureum chrysococcum*, *R. caucasicum*, *R. Cynosbati*, *R. Cynosbati inerme*, *R. diacantha*, *R. divaricatum*, *R. fasciculatum chinense*, *R. Grossularia (uva-crispa)*, *R. hirtellum*, *R. holosericeum*, *R. intermedium*, *R. longiflorum*, *R. luridum*, *R. nigrum aconitifolium*, *R. odoratum*, *R. robustum*, *R. vulgare*, *R. vulgare* (Fay's Prolific), *R. vulgare* (Small Currant), *R. vulgare* (White Currant), *Ribes* sp. (large gooseberry) and *Ribes* sp. (Smith's Small gooseberry). We are indebted to the Arnold Arboretum for most of the species of *Ribes* used in these and the other inoculations.

Uniform failure to infect leaves when spores were placed on the upper surface, where there are few or no stomates, proves infection takes place only through these, as is also shown by actual observation. It is interesting, also, to note that good infection took place with spores 35 days old and poor with those 49 days old (*i. e.*, that long after the branches containing the aecial spores were cut from the tree and left in the laboratory.)

I stage from *Pinus Strobus*: on *Ribes alpestre*, 685, Ap. 28, '19, failed; 787, My. 13, '19, failed; 1313, My. 29, '20, failed: on *R. alpinum* ♀, 687, Ap. 28, '19, failed; 792, My. 13, '19, poor, II, III: on *R. alpinum* ♂, 312, Je. 4, '18, failed; 777, My. 13, '19, failed; 886, My. 22, '19, failed; 929, Je. 4, '19, failed; 1294, My. 29, '20, failed: on *R. americanum*, 304, 309, Je. 4, '18, poor, II; 707, Ap. 28, '19, fair, II; 715, Ap. 28, '19, good, II; 726, My. 2, '19, failed (upper surface); 762, My. 13, '19, failed; 783, My. 13, '19, fair, II; 1315, My. 29, '20, poor, II; 1331, Je. 3, '20, failed?: on *R. aureum*, 313, Je. 4, '18, failed; 671, Ap. 28, '19, failed; 725, My. 2, '19, failed (upper surface); 779, My. 13, '19, failed; 1319, My. 29, '20, fair, II: on *R. aureum chrysococcum*, 305, Je. 4, '18, poor, II; 778, My. 13,

'19, fair, II; 888, My. 22, '19, failed; 932, Je. 4, '19, failed; 1305, My. 29, '20, fair, II: on *R. caucasicum*, 306, Je. 4, '18, fair, II; 697, Ap. 28, '19, fair, II; 782, My. 13, '19, fair, II; 1314, My. 29, '20, poor, II: on *R. curvatum*, 786, My. 13, '19, failed; 885, My. 22, '19, failed; 1301, My. 29, '20, failed: on *R. Cynosbati*, 789, My. 13, '19, fair, II; 1317, My. 29, '20, good, II: on *R. Cynosbati inerme*, 770, My. 13, '19, fair, II: on *R. diacantha*, 689, Ap. 28, '19, fair, II: on *R. divaricatum*, 324, Je. 4, '18, fair, II; 679, Ap. 28, '19, good, II; 727, My. 2, '19, failed (inoc. on upper surface); 758, My. 13, '19, fair, II; 1306, My. 29, '20, fair, II: on *R. fasciculatum chinense*, 699, Ap. 28, '19, fair, II; 795, My. 13, '19, poor, II: on *R. Grossularia*, 303, Je. 4, '18, failed; 693, Ap. 28, '19, failed: on *R. Grossularia* (*uva-crispa*), 772, My. 13, '19, fair, II; 1296, My. 29, '20, fair, II: on *R. giraldii*, 695, Ap. 28, '19, failed; 729, My. 2, '19, failed (inoc. on upper surface); 785, 791, My. 13, '19, failed; 887, My. 22, '19, failed; 1310, My. 29, '20, failed: on *R. hirtellum*, 327, Je. 4, '18, poor, II; 701, Ap. 28, '19, fair, II; 730, My. 2, '19 failed (inoc. on upper surface); 1293, My. 31, '20, fair, II: on *R. holosericeum*, 321, Je. 4, '18, poor, II; 1318, My. 29, '20, fair, II: on *R. intermedium*, 325, Je. 4, '18, failed; 717, Ap. 28, '19, good, II; 732, My. 2, '19, failed (inoc. on upper surface); 760 My. 13, '19, fair, II; 1312, My. 29, '20, fair, II: on *R. longiflorum*, 316, Je. 4, '18, poor, II: on *R. luridum*, 691, Ap. 28, '19, good, II; 731, My. 2, '19, failed (inoc. on upper surface); 756, My. 13, '19, fair, II; 784, My. 13, '19, failed; 1308, My. 29, '20, fair, II: on *R. multiflorum*, 311, Je. 4, '18, failed: on *R. nigrum*, 298, My. 21, '18, good, II; 317, Je. 4, '18, poor, II; 328, Je. 3, '18, good, II; 330, Je. 5, '18, good, II, III; 345, My. 23–4, '18, good, II; 350, Je. 12, '18, failed (spores 43 days old); 351, Je. 12, '18, failed (spores 39 days old); 352, Je. 12, '18, good, II (spores 35 days old); 365, Je. 26, '18, poor, II (spores 49 days old); 368, Jl. 23, '18, failed (spores 76 days old); 644, N. 26, '18, poor, II; 658, Ap. 10, '19, good, II; 661, Ap. 12, '19, fair, II; 670, Ap. 21. '19, excellent, II; 674, Ap. 28, '19, good, II; 683, Ap. 28, '19, excellent, II; 734, My. 2, '19, failed (inoc. on upper surface); 741, My. 2, '19, excellent (inoc. on lower surface); 781, My. 13, '19, fair, II; 891, My. 23, '19, failed (spores left 45 days in Petri dish); 892, My. 23, '19, failed (spores 45 days old); 1304, My. 29, '20, fair, II; 4008, Je. 15, '22, fair, II: on *R. nigrum aconitifolium*, 930, Je. 4, '19, failed; 1302, My. 29, '20, fair, II: on *R. odoratum*, 1300, My. 29, '20, good, II: on *R. orientale*, 319, Je. 4, '18, failed: on *R. oxyacanthoides*, 326, Je. 4, '18, good, II; 673, 719, Ap. 28, '19, excellent, II; 740, My. 2, '19, failed (inoc. on upper surface); 780, My. 13, '19, fair, II; 1299, My. 29, '20, fair, II: on *R. pinetorum*, 315, Je. 4, '18, failed: on *R. robustum*, 711, Ap. 28, '19, poor, II; 775, My. 13, '19, failed; 931, Je. 4, '19, good, II; 1316, My. 29, '20, fair, II; 1332, Je. 3, '20, failed?: on *R. stenocarpum*, 314, Je. 4, '18, failed; 776, My. 13,'19, failed; 1298, My. 29, '20, failed: on *P. tenue*, 709, Ap. 28,'19, failed; 737, My. 2, '19, failed (inoc. on upper surface); 768, My. 13, '19, failed; 1295, My. 29, '20, failed: on *R. urceolatum*, 310, Je. 4, '18, failed: on *R. vulgare*, 320, Je. 4, '18, fair, II; 677, Ap. 28, '19, good, II; 738, My. 2, '19, failed (inoc. on upper surface): on *R. vulgare* (Fay's Prolific), 308, Je. 4, '18, fair, II; 657, Ap. 10, '19, fair, II; 660, Ap. 12, '19, fair, II; 672, Ap. 28, '19, good, II; 713, Ap. 28, '19, poor, II; 728, My. 2, '19, failed (inoc. on upper surface); 764, My. 13, '19, good, II; 1307, My. 29, '20, poor, II: on *R. vulgare* (small currant), 318, Je. 4, '18, fair, II; 705, Ap. 28, '19, fair, II; 735, My. 2, '19, poor (1 sorus, II; prob. accidental, inoc. on upper surface); 1309, My. 29, '20, poor, II: on *R. vulgare* (white currant), 307, Je. 4, '18, fair, II; 721, Ap. 28, '19, good, II; 739, My. 2, '19, failed (inoc. on upper surface); 1311, My. 29, '20, fair, II: on *Ribes* sp. (large gooseberry), 323, Je. 4, '18, good, II; 675, Ap. 28, '19, poor, II; 681, Ap. 28, '19, failed; 733, My. 2, '19, failed (inoc. on upper surface); 774, My. 13, '19, failed; 1303, My. 29, '20, failed: on *Ribes* sp. (Smith's small gooseberry), 322, Je. 4, '18, poor, II; 703, Ap. 28, '19, fair, II; 736, My. 2, '19, failed (inoc. on upper surface); 766, My. 13, '19, failed; 1297, My. 29, '20,

Inoculations with I and repeating with II stage. These inoculations all started with the I spores from *Pinus Strobus* on the various species of *Ribes* and then were repeated on the same species of *Ribes* through the II spores produced in the successive generations. In this way we were able to produce from one to nine distinct generations on the different hosts. The most successful host for inoculation was *Ribes nigrum* on which in the best test were produced one generation from the I spores and eight generations from the II spores before failure resulted on account of the very warm summer weather. In this series the III stage appeared with the II in the seventh generation. We know of no one who has carried on so extended a generation test under such exact conditions. Other hosts on which the rust was carried for five or more generations were *Ribes Cynosbati* and *R. vulgare.*

I, II stages on *Ribes alpinum* ♀: I stage on 792 (1), My. 13, '19, poor, II, III; II on 792 (2), Je. 5, good, II, III.

I, II stages on *R. americanum*: I stage on 707 (1), Ap. 28, '19, good, II; II on 707 (2), My. 12, failed. I on 715 (1), Ap. 28, '19, fair, II; II on 715 (2), My. 12, poor, II; II on 715 (3), Je. 5, failed.

I, II stages on *R. Cynosbati*: I stage on 789 (1), My. 13, '19, fair, II; II on 789 (2), Je. 5, poor, II; II on 789 (3), Je. 23, poor, II; II on 789 (4), Jl. 15, poor, II; II on 789 (5), Jl. 25 and Au. 5, poor, II; II on 789 (6), Au. 13, failed.

I, II stages on *R. fasciculatum chinense*: I stage on 699 (1), Ap. 28, '19, fair, II; II on 699 (2), My. 12, poor, II; II on 699 (3), Je. 5, poor, II.

I, II stages on *R. hirtellum*: I on 701 (1), Ap. 28, '19, fair, II; II on 701 (2), My. 12, failed.

I, II stages on *R. intermedium*: I stage on 717 (1) ,Ap. 28, '19, fair, II; II on 717 (2), My. 14, poor, II; II on 717 (3), Je. 5, failed.

I, II stages on *R. luridum*: I stage on 691 (1), Ap. 28, '19, good, II; II on 691 (2), My. 12, poor, II; II on 691 (3), Je. 5, fair, II.

I, II stages on *R. nigrum*: I stage on 658 (1), Ap. 10, '19, good, II; II on 658 (2), Ap. 25 and My. 3, fair, II; II on 568 (3), My. 9 and 12, poor, II; II on 568 (4), Je. 4 and 23, failed. I stage on 661 (1), Ap. 12, '19, good, II; II on 661 (2), Ap. 25 and My. 3, good, II; II on 661 (3), My. 12–13, good, II; II on 661 (4), My. 24 and 28, good, II; II on 661 (5), Je. 10 and 16, good, II; II on 661 (6), Je. 20 and 23, fair, II; II on 661 (7), Jl. 14, 18 and 25, poor, II and III; II on 661 (8), Jl. 25, 28 and Au. 5, poor, II; II on 661 (9), Au. 13 and 26, fair, II, III; II on 661 (10), Au. 26, failed. I stage on 670 (1), Ap. 21, '19, excellent, II; II on 670 (2), My. 1, excellent, II; II on 670 (3), My. 12, good, II; II on 670 (4), My. 28, good, II; II on 670 (5), Je. 10, 16, good, II; II on 670 (6), Je. 20 and 23, fair, II; II on 670 (7), Jl. 23, 28, Au. 4, poor, II; II on 670 (8), Au. 26, poor, II. I stage on 674 (1), Ap. 28, '19, good, II; II on 674 (2), My. 12, fair, II; II on 674 (3), Je. 5, failed. I stage on 997 (1), Je. 16, '19, excellent, II; II on 997 (2), Jl. 12, fair, II, III; II on 997 (3), Jl. 24, 28, 30, fair, II; II on 997 (4), Au. 5 and 13, poor, II.

I, II stages on *R. oxyacanthoides*: I stage on 673 (1), Ap. 28, '19, excellent, II; II on 673 (2), My. 12, failed. I stage on 719 (1), Ap. 28, '19, excellent, II; II on 719 (2), My. 12, good, II; II on 719 (3), Je. 5 and 23, failed.

I, II stages on *R. robustum*: I stage on 931 (1), Je. 4, '19, good, II; II on 931 (2), Je. 23, poor, II; II on 931 (3), Jl. 15, 18 and 21, poor, II; II on 931 (4), Au. 1, failed.

I, II stages on *R. vulgare*: I stage on 657 (1), Ap. 10, '19, fair, II; II on 657 (2), Ap. 23, My. 3, poor, II; II on 657 (3), My. 9 and 13, poor, II;

II on 657 (4), My. 22, poor, II; II on 657 (5), Je. 5, poor, II; II on 657 (6), Jl. 15, failed. I stage on 660 (1), Ap. 12, '19, fair, II; II on 660 (2), Ap. 25, My. 3, fair, II; II on 660 (3), My. 9 and 13, poor, II; II on 660 (4), My. 21, failed.

I, II stages on *R. vulgare* (Fay's Prolific): I on 672 (1), Ap. 28, '19, good, II; II on 672 (2), My. 12, failed.

I, II stages on *R. vulgare* (small currant): I stage on 705 (1), Ap. 28, '19, fair, II; II on 705 (2), My. 12, poor, II; II on 705 (3), Je. 5, failed.

I, II stages on *R. vulgare* (white currant): I stage on 721 (1), Ap. 28, '19, good, II; II on 721 (2), My. 12, failed.

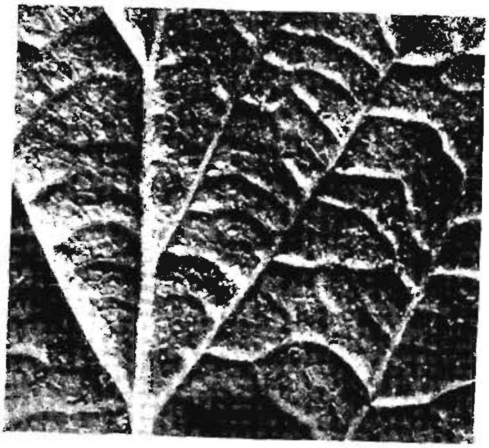
I, II stages on *Ribes* sp. (large gooseberry): I stage on 675 (1), Ap. 28, '19, poor, II; II on 675 (2), My. 12, failed.

Inoculations with II stage from *Ribes nigrum.* In this series the II spores were all from *Ribes nigrum* and were successful on the following hosts: *Ribes alpinum* ♀, *R. americanum, R. aureum chrysococcum, R. Cynosbati, R. Cynosbati inerme, R. divaricatum, R. fasciculatum chinense. R. Grossularia* (*uva-crispa*), *R. hirtellum, R. holosericeum, R. intermedium, R. longiflorum, R. luridum, R. nigrum, R. nigrum aconitifolium, R. oxyacanthoides, R. robustum, R. tenue, R. vulgare, Ribes* sp. (Smith's small gooseberry). That twenty species took out of thirty-one tried, as compared with fifteen out of twenty-five where the II spores were from *Ribes vulgare* (*q. v.*) were used, was due probably to the fact that more inoculations were made on each host and more spores used. In general the species inoculated from these two hosts corresponded quite closely in results obtained. Altogether eighty inoculations were made from *R. nigrum*, of which thirty-three or 41% were successful, which is lower than from *Ribes vulgare*, but the number of sori produced was greater than with the latter host.

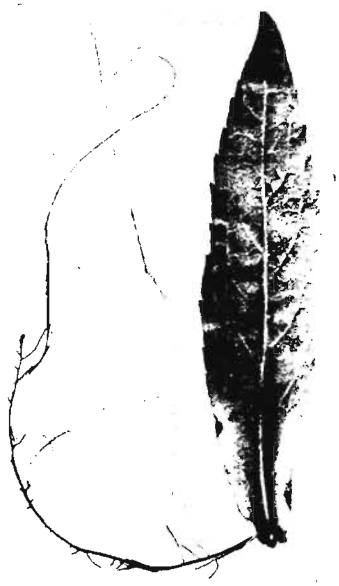
II stage from *Ribes nigrum*: on *Parnassia caroliniana*, 565, 0.3, '18, failed: on *Ribes alpestre*, 375, S. 13, '18, failed; 526, S. 28, '18, failed; 1038, Au. 6, '19, failed; 1061, Au. 13, '19, failed: on *R. alpinum* ♀, 428, S. 17, '18, fair, II, III: on *R. alpinum* ♂, 376, S. 13, '18, failed; 523, S. 28, '18, failed; 1030, Au. 6, '19, failed; 1059, Au. 13, '19, failed: on *R. americanum*, 374, S. 13, '18, fair, II, III; 1047, Au. 7, '19, failed; 1057, Au. 13, '19, failed: on *R. aureum*, 1040, Au. 7, '19, failed; 1065, Au. 13, '19, failed: on *R. aureum chrysococcum*, 392, S. 13, '18, good, II, III; 398, S. 14, '18, failed; 527, S. 28, '18, failed; 1043, Au. 7, '19, failed; 1068, Au. 13, '19, failed: on *R. caucasicum*, 381, S. 13, '18, failed; 524, S. 28, '18, failed; 1032, Au. 6, '19, failed: on *R. curvatum*, 380, S. 13, '18, failed; 529, S. 28, '18, failed; 1051, Au. 7,'19, failed; 1056, Au. 13, '19, failed: on *R. Cynosbati*, 377, S. 13, '18, good, II; 396, S. 14, '18, good, II; 1041, Au. 7, '19, poor, II: on *R. Cynosbati inerme*, 397, S. 14, '18, poor, II; 1036, Au. 6, '19, fair, II: on *R. diacantha*, 429, S. 17, '18, failed: on *R. divaricatum*, 379, S. 13, '18, good, II; 1037, Au. 6, '19, failed: on *R. fasciculatum chinense*, 399, S. 14, '18, good, II: on *R. Grossularia*, 1033, Au. 6, '19, failed: on *R. Grossularia* (*uva-crispa*), 382, S. 13, '18, fair, II: on *R. giraldii*, 378, S. 13, '18, failed; 528, S. 28, '18, failed; 1053, Au. 7, '19, failed; 1067, Au. 13, '19, failed: on *R. hirtellum*, 383, S. 13, '18, good, II, III; 1049, Au. 7, '19, failed: on *R. holosericeum*, 384, S. 13, '18, failed; 525, S. 28, '18, failed; 1048, Au. 7, '19, fair, II, III; 1063, Au. 13, '19, failed: on *R. intermedium*, 385, S. 13, '18, good, II, III; 1044, Au. 7, '19, fair, II: on *R. longiflorum*, 400, S. 14, '18, fair, II, III: on *R. luridum*, 386, S. 13, '18, good, II, III; 1046, Au. 7, '19, failed: on *R. nigrum*, 387,

a. II stage of *Cronartium Comptoniae* on *Myrica asplenifolia*, pp. 479, 484.

b. Callus on petiole of *Ribes nigrum*, p. 480.



c. II stage of *Cronartium ribicola* on *Ribes nigrum*, p. 485.



d. Roots from callus on *Solidago rugosa*, p. 480.

ARTIFICIAL INOCULATIONS IN PETRIE DISHES.

S. 13, '18, good, II, III; 997, Jl. 12, '19, fair, II; 1069, Au. 5, '19, excellent, II, III: on *R. nigrum aconitifolium*, 388, S. 13, '18, good, II, III; 1035, Au. 6, '19, fair, II, III; 1058, Au. 13, '19, fair, II: on *R. oxyacanthoides*, 395, S. 13, '18, good, II, III: on *R. robustum*, 391, S. 13, '18, good, II, III; 1031, Au. 6, '19, poor, II; 1064, Au. 13, '19, fair, II, III: on *R. stenocarpum*, 390, S. 13, '18, failed; 522, S. 28, '18, failed; 1045, Au. 7, '19, failed; 1062, Au. 13, '19, failed: on *R. tenue*, 389, S. 13, '18, good, II, III; 1042, Au. 7, '19, failed; 1060, Au. 13, '19, failed: on *R. vulgare*, 394, S. 13, '18, fair, II, III: on *R. vulgare* (white currant), 1050, Au. 7, '19, failed: on *Ribes* sp. (large gooseberry), 1052, Au. 7, '19, failed: on *Ribes* sp. (Smith's small gooseberry), 393, S. 13, '18, fair, II, III; 1034, Au. 6, '19, failed; 1066, Au. 13, '19, failed.

II from *Ribes nigrum* (Petri dish): on *R. nigrum*, 366, Je. 26, '18, good, II; 508, S. 25, '18, poor, III; 645, D. 9, '18, failed; 1027, Jl. 28 '19, fair, II.

Inoculations with II stage from *Ribes vulgare*. In this series the II spores were all from *Ribes vulgare* and successful inoculations were made on the following hosts: *Ribes americanum, R. Cynosbati, R. Cynosbati inerme, R. fasciculatum chinense, R. Grossularia (uva-crispa), R. hirtellum, R. intermedium, R. longiflorum, R. luridum, R. nigrum, R. nigrum aconitifolium, R. orientale, R. oxyacanthoides, R. robustum*, and *Ribes* sp. (Smith's small gooseberry). The best results were obtained with *R. Cynosbati, R. longiflorum, R. nigrum*, and *R. oxyacanthoides*. Of the twenty-seven inoculations made fifteen, or 56%, were successful. All the inoculations, except the last two, were made on Sept. 17, 1918.

II stage from *Ribes vulgare*: on *R. alpestre*, 402, failed: on *R. alpinum* ♀, 427, failed: on *R. alpinum* ♂, 403, failed: on *R. americanum*, 401, poor, II: on *R. aureum chrysococcum*, 420, failed: on *R. caucasicum*, 405, failed: on *R. curvatum*, 409, failed: on *R. Cynosbati*, 404, good, II: on *R. Cynosbati inerme*, 406, poor, II: on *R. fasciculatum chinense*, 421, poor, II: on *R. Grossularia (uva-crispa)*, 410, poor, II, III: on *R. giraldii*, 407, failed: on *R. hirtellum*, 412, poor, II: on *R. holosericeum*, 411, failed: on *R. intermedium*, 413, poor, II, III: on *R. longiflorum*, 425, good, II, III: on *R. luridum*, 414, poor, II, III: on *R. nigrum*, 415, good, II, III: on *R. nigrum aconitifolium*, 416, poor, II, III: on *R. orientale*, 422, poor, II: on *R. oxyacanthoides*, 426, good, II: on *R. robustum*, 417, poor, II, III: on *R. stenocarpum*, 418, failed: on *R. tenue*, 419, failed: on *R. vulgare*, 424, failed; 998 (Fay's Prolific), Jl. 12, '19, failed: on *Ribes sp.* (Smith's small gooseberry), 423, S. 17, '18, poor, III.

Inoculations with II stage from *Ribes* sps. The host species from which the II spores were obtained are uncertain but the results were quite successful in each case.

II from *Ribes* sp.: on *R. nigrum*, 299, My. 27, '18, good, II; 329, Je. 3, '18, good, II; 331, Je. 5, '18, excellent, II, III: on *R. vulgare*, 300, My. 27, '18, good, II.

Inoculations from III stage. There was no indication from these experiments that the III stage from *Ribes* could re-inoculate *Ribes*. When tried on pine leaves, however, the results were successful in one case where the juvenile-form leaves were still attached to a young shoot. Results as a rule are not to be expected even here as

no sign of infection is usually visible for a month or two after inoculation. In the successful case reported there was a slight golden-yellow spotting thirty-eight days after inoculation and sections showed the characteristic sclerotial masses present.

III stage from *Ribes nigrum:* on *Pinus Strobus*, 584 (stem uncut), O. 7, '18, failed; 585 (stem cut), O. 7, 18, failed; 589 (stems uncut and buds), O. 8, '18, failed; 583 (leaves), O. 7, '18, failed; 588, O. 8, '18, good, (yellow spots and sclerotia): on *Ribes intermedium*, 1112, O. 25 '19, failed: on *R. nigrum*, 631, O. 19, '18, failed; 1113, O. 25, '19, failed.

Gymnoconia interstitialis (Schl.) Lagerh.

Infections from the I stage resulted from *Rubus allegheniensis* on *R. allegheniensis* and *R. villosus;* from *R. hispidus* on *R. hispidus* and *R. villosus;* from *R. occidentalis* on *R. hispidus;* from *R. villosus* on *R. hispidus* and *R. villosus*. The III stage appeared in all cases. Only ten out of forty-six infections, or 22% were successful. This low rate is due in part to the leaves not keeping in good condition long enough to secure results, as it takes some time for the sori to mature.

I stage from *Rubus allegheniensis* (*R. villosus*): on *R. allegheniensis* (wild), 1357, Je. 30, '20, fair, III: on *R. villosus*, 336, 337, Je. 6, '18, failed; 1358, Je. 30, '20, good, III.

I stage from *Rubus hispidus*: on *R. hispidus*, 4302, Je. 2, '23, fair, III; 4340, Je. 15, '23, failed: on *R. villosus*, 338, 339, Je. 6, '18, failed; 959, Je. 11, '19, excellent, III; 3087, Je. 5, '22, failed; 4295, Je. 1, 4203, Je. 2, '23, failed; 4341, Je. 15, '23, good, III: on *Rubus*, sps. (wild and cult. raspberry), 3084, 3085, Je. 5, '22, failed; 4296, Je. 1, '23, failed: on *Rubus* sp. (cult. blackberry), 3086, Je. 5, '22, failed; 4294, Je. 1, '23, failed. See Plate XXVb.

I stage from *Rubus occidentalis:* on *R. allegheniensis*, 1350 (wild), 1354 (Erie), 1356, (Snyder), Je. 22, '20, failed; 3090 (cult.), Je. 5, '22, failed; 4310 (cult.), Je. 8, '23, failed; 4353 (cult.), Je. 20, '23, failed; 4356, Je. 20, '23, failed: on *R. hispidus*, 4311, Je. 8, '23, poor, III; 4354, Je. 20, '23, failed; 4357, Je. 20, '23, failed: on *R. occidentalis*, 1346, 1352, Je. 22, '20, failed: on *R. villosus*, 1348, Je. 22, '20, failed; 3091, Je. 5, '22, failed; 4309, Je. 8, '23, failed; 4352, Je. 20, '23, failed; 4355, Je. 20, '23, failed; 4581, Jl. 2, '24, failed: on *Rubus* sps. (cult. and wild raspberry), 3088–89, Je. 5, '22, failed.

I stage from *Rubus villosus* (*R. canadensis*): on *R. allegheniensis*, 4326, Je. 12, '23, failed; on *R. hispidus*, 4338, Je. 15, '23, excellent, III: on *R. villosus*, 4325, Je. 12, '23, poor, III; 4339, Je. 15, '23, failed; 4580, Jl. 2, '24, good, III; 4585, Jl. 10, '24, excellent, III.

I stage from *Rubus* sps. (wild raspberry): on *R. villosus*, 960, Je. 11, '19, failed: on *Rubus* sps. 970, Je. 13, '19, failed.

Gymnosporangium.

Of the five species tried from this genus we were successful in securing infections with only two, chiefly because the wrong host or the O stage was used with the other three. Altogether thirty-nine tests were made of which fourteen or 36% were successful. With *G. Juniperi-virginianae*, where more likely hosts were used,

46% of the inoculations were successful. With *Gymnosporangium* successful results in Petri dishes are to be expected only with the III stage and with this only the O stage appears since the length of time to develop the I stage is too great to keep the leaves alive.

Gymnosporangium clavariaeforme (Jacq.) DC.

This failure is probably due to the use of the wrong host, as *Pyrus* is not given by Kern (N. A. F.) as one for this species which usually occurs on *Amelanchier* sps., and *Cydonia vulgaris*, both hosts in Connecticut.

III stage from *Juniperus communis:* on *Pyrus ioensis* (Bechtel's Fl. Crab), 923, My. 27, '19, failed.

Gymnosporangium clavipes Ck. & Pk.

The usual hosts for this species are *Amelanchier*, *Crataegus* and *Cydonia*, although Kern (N. A. F.) gives *Pyrus Malus* as a host from Massachusetts. *Pyrus*, however, does not seem to be a very susceptible host from our results.

O stage from *Amelanchier* sp.: on *Pyrus ioensis*, 936, Je. 6, '19, failed.
III stage from *Juniperus virginiana:* on *Pyrus ioensis* (Bechtel's Fl. Crab) 922, My. 27, '19, failed: on *P. Malus* (Wealthy) 811, My. 20, '19, failed.

Gymnosporangium cornutum (Pers.) Arth.

As in all species tried no results were obtained from inoculations with the O stage. This rust, however, has not been listed on the hosts tried here so the results do not mean so much as if *Sorbus* had been used.

O stage from *Sorbus americana:* on *Crataegus crus-galli*, 967, Je. 12, '19, failed: on *Pyrus ioensis*, 968, Je. 12, '19, failed: on *P. Malus* (Wealthy), 969, Je. 12, '19, failed.

Gymnosporangium Juniperi-virginianae Schw.

Here inoculations with the O stage were made on hosts known to be very susceptible but without results which seems to indicate that the O stage is not a means of spreading the rust. Inoculations with the III stage were successful on *Pyrus ioensis* and *P. Malus* only, the other species, *Pyrus communis* and *Cydonia vulgaris*, not being reported as hosts for this species by Kern. All three inoculations took on the Bechtel's Flowering Crab which is a very susceptible species. On *Pyrus Malus*, however, the results varied with the different varieties used, failing on Baldwin, Gravenstein, McIntosh and Northern Spy, taking poorly on Fall Pippin, Greening, King and Sutton's Beauty, and taking well on Duchess of Oldenburg, Hurlburt, Russet and Wealthy. These results agree well with the observations we have made on these varieties

in nature. The Petri dish method seems to be a very easy way to test the susceptibility of different varieties of apples to these rusts. Of the inoculations with the III stage 52% were successful.

O stage from *Pyrus Malus*: on *Pyrus ioensis*, 953, Je. 9, '19, failed: on *Pyrus Malus* (Wealthy), 954, Je. 9, '19, failed; 4030–32 (young and old leaves), Je. 20, '22, failed.

I stage from *Pyrus Malus*: on *Juniperus virginiana*, 1029, Au. 5, '19, failed.

III stage from *Juniperus virginiana*: on *Cydonia vulgaris*, 801, My. 19, '19, failed; 940, Je. 7, '19, failed: on *Pyrus communis*, 800, My. 19, '19, failed; 938 (Seckel), Je. 7, '19, failed; 939, Je. 7, '19, failed: on *P. ioensis* (Bechtel's Fl. Crab), 799, My. 19, '19, excellent, O; 924, My. 27, '19, poor, O; 937, Je. 7, '19, good, O; 4306, Je. 7, '23, excellent, O: on *P. Malus*, 798, My. 19, '19, failed; 810 (Baldwin), My. 20, '19, failed; 942 (Baldwin), Je. 7, '19, failed; 943 (Duchess of Oldenberg), Je. 7, '19, good, O; 941 (Fall Pippin), Je. 7, '19, poor, O; 946 (Gravenstein), Je. 7, '19, failed; 952 (Greening), Je. 7, '19, poor, O; 950 (Hulbert), Je. 7, '19, good, O; 946 (King), Je. 7, '19, poor, O; 947 (McIntosh), Je. 7, '19, failed; 944 (Northern Spy), Je. 7, '19, failed; 951 (Russet), Je. 7, '19, good, O; 948 (Sutton's Beauty), Je. 7, '19, poor, O; 809 (Wealthy), My. 20, '19, good, O; 949 (Wealthy), Je. 7, '19, poor, O. See Plate XXVc.

Gymnosporangium nidus-avis Thaxt.

Successful inoculations were made with this species only on Quince (*Cydonia vulgaris*) and the Wealthy apple, failing on the other varieties of *Pyrus Malus*, the Pear and Bechtel's Crab. Wealthy is one of the most susceptible varieties of apples to *Gymnosporangium Juniperi-virginianae* but Kern (N. A. F. **7**³: 196.) does not list *Pyrus Malus* as a host for *G. nidus-avis* and it may be that in nature it does not attack the apple.

III stage from *Juniperus virginiana*: on *Cydonia vulgaris*, 805, My. 19, '19, fair, O: on *Pyrus communis*, 804, My. 19, '19, failed: on *P. ioensis*, 803, My. 19, '19, failed: on *P. Malus*, 802, My. 19, '19, failed; 813 (Baldwin), My. 20, '19, failed; 812 (Wealthy), My. 20, '19, fair, O.

Kuehneola albida (Kuehn) Magn.

Only two inoculations out of nine were successful with this species, taking from *Rubus allegheniensis* and *R. hispidus* on the same species. This seems too low considering the hosts and character of the spore material used, but perhaps the lateness of the season with some of the inoculations explains their failure.

II stage from *Rubus allegheniensis*: on *R. allegheniensis*, 1070, S. 9, '19, poor, II: on *R. villosus*, 1071, S. 9, '19, failed: on *Rubus* sp. (raspberry), 1072, S. 9, '19, failed.

II stage from *Rubus hispidus*: on *R. hispidus*, 4298, Je. 1, '23, fair, II: *R. villosus*, 4297, Je. 1, '23, failed.

II stage from *Rubus villosus*: on *R. villosus*, 4621, S. 16, '24, failed.

II stage from *Rubus* sp. (wild blackberry), on *R. allegheniensis*, 1546, N. 10, '20, failed: on *R. villosus*, 1545, N. 10, '20, failed: on *Rubus* sp. (cult. raspberry), 1547, N. 10, '20, failed.

Melampsora sps.

We have carried on a considerable number of inoculations with *Melampsora* species from *Populus* and *Salix* on various species of *Betula, Populus* and *Salix*. Uniform failure to inoculate *Betula*, on both trees and in Petri dishes, has eliminated the rust on that host from consideration, on infectional as well as on morphological grounds, as stated subsequently under *Melampsoridium*. The only reason for making these inoculations was the frequent association of the *Betula* rust with those on *Populus* and *Salix*.

Examining our Connecticut herbarium specimens on *Populus* and *Salix*, we find that there are slight morphological characters that apparently separate them into four species, two on *Salix* and two on *Populus*. Yet we are not sure whether these might not be more satisfactorily combined in fewer species. Our inoculations have also given conflicting results, II spores from both *Populus grandidentata* and *P. tremuloides* having apparently infected leaves of *Salix*; also II spores from *Populus tremuloides* took on *P. grandidentata* but not from the latter on the former, while II spores from *Salix* sp. failed on both the poplars. The rusts on these three hosts have been found associated in the same locality with *Caeoma Abietis-canadensis* and their II stages are very similar. All these observations have caused us to question whether we were dealing with three or one species. See notes under each.

Melampsora Abietis-canadensis (Farl.) Ludw.

The inoculations with the I stage (*Caeoma Abietis-canadensis*) from *Tsuga canadensis* took in all the tests (except possibly one) on *Populus grandidentata* and failed on *Betula* and *Salix* sps. and on all the other species of *Populus* except one doubtful sorus on *P. tremuloides*, the other two trials on this host failing though taking at the same time on *P. grandidentata*. The inoculations with the II stage from *Populus grandidentata* were uniformly failures, even on *P. grandidentata*, except the very suspicious infection on *Salix* sp. which leaves possibly were already infected, as the first sori appeared within five days after inoculation.

I stage from *Tsuga canadensis*: on *Betula* sp., 4010, Je. 17, '22, failed: on *Populus alba*, 4009, Je. 16, '22, failed; 4014, Je. 17, '22, failed: on *P. deltoides*, 3096, Je. 15, '22, failed: on *P. grandidentata*, 3094, Je. 15, '22, fair, II; 4011, Je. 17, '22, poor, II; 4021, Je. 19, '22, failed?; 4586, Jl. 10, '24, poor, II: on *P. nigra italica*, 3093, Je. 15, 4013, Je. 17, '22, failed: on *P. tremuloides*, 3095, Je. 15, '22, poor, II (one sorus); 4012, Je. 17, '22, failed; 4587, Jl. 10, '24, failed: on *Salix* sps., 4401–2, Je. 15, '22, failed; 4015–18, Je. 17, '22, failed; 4022–29, Je. 19, '22, failed.

II stage from *Populus grandidentata*: on *Betula lenta*, 557, O. 2, '18, failed: on *B. populifolia*, 554, O. 2, '18, failed: on *Populus deltoides*, 1510, O. 28, '20, failed: on *P. grandidentata*, 560, O. 2, '18, failed; 1498, O. 27, '20, failed; 1500, O. 28, '20, failed: on *P. tremuloides*, 563, O. 2, '18, failed; 1497, O. 27, '20, failed: on *Salix* sp. (New Haven), 1501, O. 28, '20, fair, II.

Melampsora americana Arth.

The II stage from *Salix* sps. failed on the three species of *Betula* and the six of *Populus* that were inoculated. It also failed on certain species of *Salix* but took on others, six of the twelve inoculations being successful.

II stage from *Salix* sp: on *Betula alba papyrifera*, 448, S. 20, '18, failed: on *B. lenta*, 449, S. 20, '18, failed; 1451, O. 14, '20, failed; 1489, O. 27, '20, failed; 1512, O. 28, '20, failed: on *B. populifolia*, 450, S. 20, '18, failed; 1450, O.14, '20, failed; 1490, O. 27, '20, failed; 1513, O. 28, '20, failed: on *Populus alba*, 451, S. 20, '18, failed; 1509, O. 28, '20, failed; 1519, O. 28, '20, failed: on *P. balsamifera*, 452, S. 20, '18, failed: on *P. deltoides*; 453, S. 20, '18, failed; 1504, O. 28, '20, failed; 1520, O. 28, '20, failed: on *P. grandidentata*, 454, S. 20, '18, failed; 1449, O. 14, '20, failed; 1492, O. 27, '20, failed; 1507, 1517, O. 28, '20, failed: on *P. nigra italica*, 455, S. 20, '18, failed; 1508, 1518, O. 28, '20, failed: on *P. tremuloides*, 456, S. 20, '18, failed; 1448, O. 14, '20, failed; 1491, O. 27, '20, failed; 1506, 1516, O. 28, '20, failed: on *Salix amygdalina* (3), 484, S. 21, '18, poor, II; 495, S. 21, '18, failed: on *S. amygdalina americana* (2), 494, S. 21, '18, failed: on *S. pentandra* (5, Lemley), 497, S. 21, '18, poor, II; 1502, 1514, O. 28, '20, failed; on *S. purpurea* (1 and 4), 493, 496, S. 21, '18, failed; on *Salix* sp. (New Haven), 1447, O. 14, '20, poor, II; 1503, O. 28, '20, good, II; 1505, O. 28, '20, poor, II; 1515, O. 28, '20, poor, II.

Melampsora Medusae Thuem.

The inoculations with the II stage from *Populus tremuloides* on the same host took in good shape in three out of the four trials and failed on all the other species of *Populus*, *Betula* and *Salix*, except apparently in one case on *Populus grandidentata* and one on *Salix* sp. made at the same time and with same material that took on *P. tremuloides*. This means either that these two latter hosts were already infected when used or else that all three hosts are inhabited by the same species and not by three different ones as considered here.

II stage from *Populus tremuloides:* on *Betula alba*, 430, S. 20, '18, failed: on *Betula lenta*, 431, S. 20, '18, failed; 558, O. 2, '18, failed; 1461, O. 14, '20, failed: on *B. populifolia*, 432, S. 20, '18, failed; 555, O. 2, '18, failed; 1460, O. 14, '20, failed: on *Populus alba*, 433, S. 20, '18, failed: on *P. balsamifera*, 434, S. 20, '18, failed: on *P. deltoides*, 435, S. 20, '18, failed: on *P. grandidentata*, 436, S. 20, '18, failed; 561, O. 2, '18, failed; 1459, O. 14, '20, good, III: on *P. nigra italica*, 437, S. 20, '18, failed: on *P. tremuloides*, 438, S. 20, '18, good, II; 465, S. 20, '18, fair, II-III; 564, O. 2, '18, failed; 1458, O. 14, '20, good, II: on *Salix amygdalina* (3), 505, S. 21, '18, failed: on *S. amygdalina americana* (2), 504, S. 21, '18, failed: on *S. pentandra* (5), 507, S. 21, '18, failed: on *S. purpurea* (1), 503, S. 21, '18, failed: *S. purpurea* (4), 506, S. 21, '18, failed: on *Salix* sp. (New Haven), 1457, O. 14, '20, poor, II.

Melampsoridium betulinum (Pers.) Kleb.

All six inoculations with the I stage failed, but only one was made on *Betula* species. Only 18% of the thirty-three inoculations with the II stage was successful also for the reason that many

of them were made on *Populus* and *Salix.* In this state rusts on *Populus, Salix* and *Betula* often occur together and it was thought that possibly there might be some connection between them not yet discovered. As far as *Betula* is concerned both from these experiments and microscopical examination of the II stage found on it, there is but one species of rust and it does not occur on either *Populus* or *Salix.* If we consider only the inoculation from *Betula* sps. to *Betula* sps., the results are better, since 38% of these was successful. The favorable inoculations with the II stage were as follows: from *Betula populifolia* on *B. lenta* and *B. populifolia.* In the case of spores from *B. lenta* on these two hosts the results were negative probably because the number of inoculating spores was small.

I stage from *Larix americana:* on *Betula* sp., 4316, Je. 8, '23, failed: on *Populus deltoides,* 4314, Je. 8, '23, failed: on *P. grandidentata,* 4312, Je. 8, '23, failed: on *P. nigra italica,* 4313, Je. 8, '23, failed: on *Salix* sp., 4305, Je. 7, 4315, Je. 8, '23, failed.

II stage from *Betula lenta:* on *B. lenta,* 1485, O. 27, '20, failed: on *B. populifolia,* 1486, O. 27, '20, failed: on *Populus grandidentata,* 1488, O, 27, '20, failed: on *P. tremuloides,* 1487, O. 27, '20, failed.

II stage from *Betula populifolia:* on *B. alba papyrifera,* 439, S. 20, '18, failed: on *B. lenta,* 440, S. 20, '18, failed; 556, O. 2, '18, failed; 1456, O. 14, '20, poor, II; 1493, O. 27, '20, fair, II: on *B. populifolia,* 441, S. 20, '18, fair, II; 553, O. 2, '18, failed; 1455, O. 14, '20, failed; 1494, O. 27, '20, failed; 1499, O. 28, '20, poor, II; 1511, O. 28, '20, poor, II: on *Populus alba,* 442, S. 20, '18, failed: on *P. balsamifera,* 443, S. 20, '18, failed: on P. *deltoides,* 444, S. 20, '18, failed: on *P. grandidentata,* 445, S. 20, '18, failed; 559, O. 2, '18, failed; 1454, O. 14, '20, failed; 1496, O. 27, '20, failed: on *P. nigra italica,* 446, S. 20, '18, failed: on *P. tremuloides,* 447, S. 20, '18, failed; 562, O. 2, '18, failed; 1453, O. 14, '20, failed; 1495, O. 27, '20, failed: on *Salix amygdalina* (3), 500, S. 21, '18, failed: on *S. amygdalina americana* (2), 499, S. 21, '18, failed: on S. *purpurea* (1), 498, S. 21, '18, failed: on *S. purpurea* (4), 501, S. 21, '18, failed: on *S. pentandra* (5), 502, S. 21, '18, failed: on *Salix* sp., 1452, O. 14, '20, failed.

Melampsoropsis Cassandrae (Pk. & Clint.) Arth.

The results in this case are interesting since they confirm results obtained with plants in crocks, namely that *Picea mariana* and *P. rubra* are susceptible hosts for producing the O and I stages of this rust, while *P. excelsa* is not. The inoculations in the Petri dishes were made on leaves still attached to small branches and the O stage with pycniospores only appeared, the I stage appearing on the plants in the crocks.

III stage from *Cassandra calyculata:* on *Picea excelsa,* 347, Je. 8, '18, failed; 925, My. 27, '19, failed: on *P. mariana,* 956, Je. 11, '19, fair, O: on *P. rubra,* 972, Je. 14, '19, fair, O.

Melampsoropsis Pyrolae (D.C.) Arth.

This rust apparently winters over here through the II stage, as the I stage has not been found. It is not evident why the two

inoculations with the II stage failed since the leaves remained alive and healthy in the Petri dishes for a long time, and the spores seemed in good condition when used.

II stage from *Pyrola americana:* on *P. americana*, 4301, Je. 2, '23, failed: on *P. elliptica*, 4300, Je. 2, '23, failed.

Phragmidium Potentillae (Pers.) Karst.

Inoculations were successful in two out of the three tests of the II stage on *Potentilla canadensis* on the same host. The other attempts were made on plants known not to be the proper hosts.

II stage from *Potentilla canadensis*: on *Betula populifolia*, 569, O. 3, '18, failed: on *Populus grandidentata*, 568, O. 3, '18, failed: on *P. tremuloides*, 567, O. 3, '18, failed: on *Potentilla canadensis*, 566, O. 3, '18, failed; 996, Jl. 12, '19, poor, II; 1014, Jl. 19, '19, fair, II; 1014, II, a-b, Au. 5, '19, (a) excellent, II, (b) failed. See Plate XXVa.

Phragmidium subcorticium (Schr.) Wint.

With this species five out of the nine inoculations on *Rosa* species were successful. The failures seem to indicate that they were on varieties that were at least somewhat resistant to the rust.

II stage from *Rosa* sp. (cult.): on *Rosa rugosa*, 987, Jl. 12, '19, failed: on *Rosa* sp. (The Farquhar), 993, Jl. 12, '19, failed: on *Rosa* sp. (Ayrshire), 989, Jl. 12, '19, failed: on *Rosa* sp., 992, Jl. 12, '19, poor, II: on *Rosa* sp. (Frau Karl Druschki's hybrid perpetual), 994, Jl. 12, '19, poor, II: on *Rosa* sp. (Madame Plantier), 991, Jl. 19, '19, poor, II: on *Rosa* sp. (white), 990, Jl. 12. '19, poor, II: on *Rosa* sp. (Wichuraina), 988, Jl. 12, '19, failed.

II stage from *Rosa* sp. (Madame Plantier, Petri dish culture 991): on *Rosa* sp. (Madame Plantier), 1025, Jl. 25, '19, poor, II.

Puccinia sps.

We can discuss the results of inoculation with species of *Puccinia* altogether as the number of inoculations with most of them were too few to draw any special conclusions. In fact the work with *Puccinia*, as with *Uromyces*, was chiefly to determine how successful the Petri dish method would prove for those species of rusts that have their hosts on the more delicate leaves of herbaceous plants, many of which are also of such size that they have to be cut before they can be placed in the dish. Of the forty-six inoculations 35% was successful which is fair considering the difficulty of keeping the leaves in good condition. However, even with the successful ones, the amount of infection was not usually very abundant and often the sori appeared only shortly before the leaves died.

Altogether nineteen species of *Puccinia* were tried and infection resulted in nine as follows. *Puccinia Agropyri*: II stage from *Agropyron repens* on *A. repens*; II stage from *Triticum vulgare* on *Agropyron repens*. *Puccinia coronata*: II stage from *Avena sativa*

on *A. sativa*. *Puccinia graminis*: II stage from *Agrostis alba* on *A. alba*; II stage from *Phleum pratense* on *P. pratense*. *Puccinia obscura:* II stage from *Luzula campestris* on *L. campestris*. *Puccinia Poarum:* II stage from *Poa pratensis* on *P. pratensis*. *Puccinia Pruni-spinosae:* I stage from *Anemone quinquefolia* on *Prunus serotina*. *Puccinia suaveolens:* II stage from *Cirsium arvense* on *C. arvense*. *Puccinia Violae:* I stage from *Viola blanda* on *V. blanda*. *Puccinia Thalictri:* III stage from *Thalictrum polygamum* on *P. polygamum*. (This last infection is considered doubtful).

Puccinia Agropyri Ell. & Ev.

I stage from *Thalictrum polygamum:* on *Carex* sp., 4332, Je. 13, '23, failed.

II stage from *Agropyron repens:* on *A. repens*, 1013, Jl. 19, '19, poor, II; 1028, Jl. 28, '19, failed; 4346, Je. 16, '23, failed: on *Panicum* sp., 999, Je. 12, '19, failed.

II stage from *Triticum vulgare:* on *Agropyron repens*, 1023, Jl. 19, '19, poor, II.

Puccinia Andropogi Schw.

I stage from *Chelone glabra:* on *Andropogon scoparius*, 4330, Je. 13, '23, fair, II; 4342, Je. 15, '23, failed.

III stage from *Andropogon scoparius:* on *Chelone glabra*, 4331, Je. 13, '23, failed.

Puccinia Anemones Pers.

III stage from *Anemone quinquefolia* (poor material): on *A. quinquefolia*, 4321, Je. 12, '23, failed: on *Thalictrum* sp., 4320, Je. 12,'23, failed.

Puccinia Asparagi DC.

II stage from *Asparagus officinalis:* on *A. officinalis*, 1055, Au. 12, '19, failed.

Puccinia coronata Cda.

II stage from *Avena sativa:* on *A. sativa*, 581, O. 7, '18, fair, II; 632, O. 22, '18, good, II, III; 641, O. 31, '18, poor, II; (II stage from Petri dish culture 632), 642, O. 31, '18, poor, II: on *Secale cereale*, 633, O. 22, '18, failed.

Puccinia Ellisiana Thuem.

I stage from *Viola* sp.: on *Andropogon* sp., 4343, Je. 15, '23, failed: on *Viola* sp., 4334, Je. 15, '23, failed.

Puccinia Eriophori Thuem.

I stage from *Senecio aureus:* on *Eriophorum viridi-carinatum*, 4322, Je. 12, '23, failed.

III stage from *Eriophorum viridi-carinatum:* on *Senecio aureus*, 4324, Je. 12, '23, failed.

Puccinia Fraxinata (Lk.) Arth.

I stage from *Fraxinus americana:* on *Agropyron repens*, 1010, Jl. 19, '19, failed: on *Fraxinus americana*, 1008, Jl. 19, '19, failed: on *Spartina patens juncea*, 1003, Jl. 18, '19, failed; 1005, Jl. 19, '19, failed: on *Spartina* sp. (large), 1002, Jl. 18, '19, failed; 1004, Jl. 19, '19, failed.

Puccinia graminis Pers.

I stage from *Berberis vulgaris:* on *Agrostis alba,* 4329, Je. 13, '23, failed.
II stage from *Agrostis alba:* on *A. alba,* 1011, Jl. 19, '19, poor, II.
II stage from *Phleum pratense:* on *P. pratense,* 1012, Jl. 19, '19, fair, II.

Puccinia Malvacearum Mont.

III stage from *Althaea rosea:* on *A. rosea,* 995, Jl. 12, '19, failed.

Puccinia obscura Schroet.

II stage from *Luzula campestris:* on *L. campestris,* 359, Je. 21, '18, failed; 934, Je. 6, '19, good, II.

Puccinia Poarum Niels.

II stage from Poa pratensis: on P. pratensis, 1000, Jl. 12, '19, poor, II.

Puccinia Porri (Sow.) Wint.

II stage from *Allium cepa* (Egyptian): on *A. cepa* (garden), 1054, Au. 12, '19, failed.

Puccinia Pruni-spinosae Pers.

I stage from *Anemone quinquefolia:* on *Prunus persica,* 4249, My. 19, '23, failed: on *Prunus serotina,* 900, My. 27, '19, poor, II; 4250, My. 19, '23, excellent, II: on *Prunus* sp. (cult. plum), 4248, My. 18, '23, failed.

Puccinia rubigo-vera (DC.) Wint.

II stage from *Secale cereale:* on *S. cereale,* 344, Je. 8, '18, failed.

Puccinia suaveolens (Pers.) Rostr.

II stage from *Cirsium arvense:* on *C. arvense,* 1018, Jl. 19, '19, fair, II; 1026, Jl. 28, '19, poor, II.

Puccinia Taraxaci Plowr.

II stage from *Taraxacum officinale:* on *T. officinale,* 1001, Jl. 14, '19, failed (leaves decayed); 4345, Je. 16, '23, failed.

Puccinia Thalictri Chev.

III stage from *Thalictrum polygamum:* on *T. polygamum,* 4318, Je. 12, '23, good, III (telia appeared in six days so host possibly already infected)?; 4347, Je. 16, '23, failed.

Puccinia Violae (Schum.) DC.

I stage from *Viola blanda:* on *V. blanda,* 935, Je. 6, '19, good, II.

Pucciniastrum Myrtilli (Schum.) Arth.

The reason the I stage took on *Gaylussacia baccata* and failed on *Vaccinium vacillans* is not entirely evident since the latter, questionably, has been collected as host for the II and III stages in this

state, and they were inoculated under apparently identical conditions. However, the *Gaylussacia* is a common host and the same year the inoculations were made we found it and *Vaccinium pennsylvanicum* infected together in a locality where *V. vacillans* was entirely free though close to the other infected hosts.

I stage from *Tsuga canadensis:* on *Gaylussacia baccata,* 4020, Je. 19, '22, excellent, II: 4041, Jl. 19, '22, good, II: on *Vaccinium vacillans,* 4019, Je. 19, '22, failed; 4042, Jl. 19, '22, failed.

Uromyces sps.

Only eight inoculations with five species of *Uromyces* were tried and of these only one was successful as follows. *Uromyces Trifolii:* II stage from *Trifolium pratense* on *T. pratense.*

Uromyces Caladii (Schw.) Farl.

I stage from *Arisaema triphyllum:* on *A. triphyllum,* 4307, Je. 8, '23, failed.

Uromyces Caryophyllinus (Schr.) Wint.

II stage from *Dianthus Caryophyllinus:* on *D. Carophyllinus,* 646, 647, 648, 649, D. 27, '18, failed.

Uromyces houstoniatus (Schw.) Sheld.

I stage from *Houstonia caerulea:* on *Hypoxis erecta,* 4282, My. 28, '23, failed: on *Luzula campestris,* 360, Je. 21, '18, failed: on *Sisyrinchium* sp., 4299, Je. 1, '23, failed.

Uromyces Lilii (Lk.) Fckl.

I stage from *Lilium* sp.: on *Lilium* sp., 361, Je. 21, '18, failed.

Uromyces Trifolii (Hedw.) Liro.

II stage from *Trifolium pratense:* on *T. hybridum,* 1017, Jl. 19, '19, failed: on *T. pratense,* 1015, Jl. 19, '19, poor, II.

TABLE I. RESULTS OF INOCULATIONS OF *Ribes* SPS. WITH *Cronartium ribicola*.

Comparison of Petri dish with pot inoculations.*

O—failure, P—poor, F—fair, G—good, E—excellent.

Scientific name of host inoculated.	I stage from Pinus Strobus. On leaves in Petri dishes.	I stage from Pinus Strobus. On plants in crocks.	II stage from Ribes species. On leaves in Petri dishes.	II stage from Ribes species. On plants in crocks.	Average of tests.
Ribes alpestre	O in 3 tests.	O in 5 tests.	O in 5 tests.	No test.	O in 13 tests.
" alpinum ♂	O in 5 tests.	O in 2 tests.	O in 5 tests.	O in 1 test.	O in 13 tests.
" " ♀	P+ in 3 tests.	F+ in 4 tests.	F− in 3 tests.	P in 1 test.	F− in 11 tests.
" americanum	F− in 9 tests.	F− in 6 tests.	P− in 7 tests.	P in 2 tests.	P+ in 24 tests.
" aureum	P− in 5 tests.	F in 1 test.	O in 2 tests.	No test.	P− in 8 tests.
" " chrysococcum	P in 5 tests.	No test.	P− in 6 tests.	No test.	P− in 11 tests.
" caucasicum	F− in 4 tests.	F− in 3 tests.	O in 4 tests.	No test.	P+ in 11 tests.
" curvatum	O in 3 tests.	No test.	O in 5 tests.	No test.	O in 8 tests.
" Cynosbati	F+ in 3 tests.	F− in 1 test.	F− in 9 tests.	F in 1 test.	F− in 14 tests.
" " inerme	F in 1 test.	G in 1 test.	P+ in 3 tests.	No test.	F− in 5 tests.
" diacantha	F in 1 test.	F+ in 3 tests.	O in 1 test.	No test.	F− in 5 tests.
" divaricatum	F− in 5 tests.	G in 3 tests.	F− in 2 tests.	F in 1 test.	F+ in 11 tests.
" fasciculatum Chinense	F− in 3 tests.	F in 1 test.	F− in 4 tests.	No test.	F− in 8 tests.
" gracile	No test.	No test.	No test.	O in 1 test.	O in 1 test.
" Grossularia	O in 2 tests.	P in 1 test.	O in 1 test.	No test.	P− in 4 tests.
" " (uva-crispa)	F in 2 tests.	G in 1 test.	P+ in 2 tests.	No test.	F in 5 tests.
" giraldii	O in 6 tests.	O in 3 tests.	O in 5 tests.	No test.	O in 14 tests.
" hirtellum	P+ in 5 tests.	F+ in 4 tests.	P in 4 tests.	E in 1 test.	F− in 14 tests.
" holosericeum	F− in 2 tests.	No test.	P− in 5 tests.	No test.	P− in 7 tests.
" intermedium	F− in 6 tests.	G in 3 tests.	P+ in 5 tests.	G in 1 test.	F− in 15 tests.
" longiflorum	P in 1 test.	No test.	G− in 2 tests.	No test.	F in 3 tests.
" luridum	F− in 6 tests.	G− in 3 tests.	P+ in 5 tests.	P in 1 test.	F− in 15 tests.

TABLE I. RESULTS OF INOCULATIONS OF *Ribes* SPS. WITH *Cronartium ribicola*.

Comparison of Petri dish with pot inoculations.—*Concluded.*

O—failure, P—poor, F—fair, G—good, E—excellent.

Scientific name of host inoculated.	I stage from Pinus Strobus.		II stage from Ribes species.		Average of tests.
	On leaves in Petri dishes.	On plants in crocks.	On leaves in Petri dishes.	On plants in crocks.	
Ribes multiflorum	O in 1 test.	No test.	No test.	No test.	O in 1 test.
" nigrum	F+ in 27 tests.	G− in 19 tests.	F+ in 35 tests.	F in 23 tests.	F+ in 104 tests.
" " aconitifolium	P in 2 tests.	No test.	F in 4 tests.	No test.	F− in 6 tests.
" odoratum	G. in 1 test.	O in 1 test.	No test.	No test.	F in 2 tests.
" orientale	O in 1 test.	No test.	P in 1 test.	O in 1 test.	P− in 3 tests.
" oxyacanthoides	G in 8 tests.	F+ in 6 tests.	F− in 5 tests.	P+ in 3 tests.	F+ in 22 tests.
" petraeum	No test.	F in 1 test.	No test.	No test.	F in 1 tests.
" pinetorum	O in 1 test.	G in 2 tests.	No test.	G in 1 test.	F+ in 4 tests.
" robustum	F− in 5 tests.	G− in 2 tests.	P+ in 7 tests.	No test.	F− in 14 tests.
" stenocarpum	O in 3 tests.	No test.	O in 5 tests.	No test.	O in 8 tests.
" tenue	O in 4 tests.	F in 2 tests.	F− in 4 tests.	No test.	P+ in 10 tests.
" urceolatum	O in 1 test.	No test.	No test.	No test.	O in 1 test.
" vulgare	F− in 5 tests.	G in 4 tests.	P+ in 11 tests.	O in 2 tests.	F− in 22 tests.
" " (Fay's prolific)	F− in 9 tests.	F+ in 8 tests.	O in 2 tests.	F− in 5 tests.	F− in 24 tests.
" " (Small)	F− in 5 tests.	G− in 8 tests.	P− in 2 tests.	P+ in 3 tests.	F− in 18 tests.
" " (White	F in 5 tests.	G− in 7 tests.	O in 2 tests.	F in 1 test.	F in 15 tests.
" Wolfii	No test.	No test.	No test.	P in 1 test.	P in 1 test.
" sp. (Large gooseberry)	F− in 7 tests.	P− in 9 tests.	O in 2 tests.	O in 2 tests.	P in 20 tests.
" " (Smith's gooseberry)	P− in 5 tests.	P in 9 tests.	P− in 4 tests.	P− in 4 tests.	P− in 22 tests.
Totals	P+ in 170 tests.	F− in 123 tests.	P+ in 169 tests.	F− in 56 tests.	518 tests.
Percent. successful	66%	78%	57%	57%	65%

* Average of the tests given in each case.

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CONNECTICUT
AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

Second Annual Report

OF THE

TOBACCO STATION

AT

WINDSOR

For the year ending October 31, 1923

The Connecticut Agricultural Experiment Station

and

The Connecticut Valley Tobacco Improvement Association

coöperating

LETTER OF TRANSMITTAL

To His Excellency, Charles H. Templeton, Governor of Connecticut:

The Board of Contro' of the Connecticut Agricultural Experiment Station herewith submits the Second Annual Report of the Tobacco Station for the year ending October 31, 1923, as required by Act of the General Assembly. (Chapter 184, Public Acts, 1921.)

Respectfully,

George A. Hopson,

Secretary.

REPORT OF

E. H. JENKINS, Director

IN ACCOUNT WITH

Tobacco Research Appropriation

(Public Acts, 1921, Chap. 184)

For the fiscal year ended June 30, 1923

RECEIPTS.

From State Comptroller for vouchers sent by E. H. Jenkins, Director		$5,189.63

EXPENDITURES.

Labor	$1,568.14	
Publications	76.52	
Telephone and telegraph	5.20	
Team and horse hire and carting	279.24	
Water	5.00	
Photographic supplies	3.50	
Miscellaneous supplies	9.73	
Fertilizer	871.54	
Tools, machinery and appliances (new purchases)	317.10	
Travel	46.11	
Surveying	36.50	
Buildings (new) (part of tobacco shed)	1,971.05	
Total		$5,189.63

Second Annual Report

OF THE

TOBACCO STATION

For the year ending October 31, 1923.

Introduction.

The Connecticut Tobacco Station has now completed its second year. The method of its establishment is detailed in the First Annual Report, since which time the state funds have been increased and the financial support of the work assured. The co-operative arrangement between the Station and the Connecticut Valley Tobacco Improvement Association has continued to be mutually satisfactory.

The intent and purpose of those instrumental in the establishment of the Tobacco Station was:

A. To provide for intensive research work on tobacco diseases, fertilization, curing and other problems of the industry.

B. To place at the service of the entire industry the best information and advice that is available.

It is the aim of the station to carry out this program as fully and rapidly as possible. The resignation of Dr. Chapman and the difficulty experienced in finding a suitable successor have made the second phase hard to realize but the experimental work has gone forward without interruption. It should be kept in mind that final conclusions may not be hastily drawn from work of this character. Seasons vary, unusual conditions affect results and only after repeated trials is it safe to speak with any assurance. Moreover, a large undertaking of this nature gets under way slowly.

Staff

Dr. G. H. Chapman, who had been in direct charge at Windsor from the beginning resigned on August 1, 1923 to take a commercial position. Due to his energy and ability, the work of this new institution ran smoothly and efficiently. Mr. C. M. Slagg, previously in charge of the Federal tobacco investigations in the Valley took charge in August, 1923 and carried out the plans for the 1923 crop.

Buildings and Equipment

A new curing barn, designed by Dr. Chapman, has been erected and was used for the 1923 crop. This barn is designed to make possible certain experiments on curing, especially as to methods of

ventilation and firing for stalk tobaccos, but as yet there is not sufficient land on which to grow the tobacco necessary.

Before leaving, Dr. Chapman made preliminary plans for a laboratory and office building, but was unable to begin its construction. Mr. Slagg completed the plans and the building is now finished. We are therefore provided with good facilities, not only for laboratory work, but will be able to sort our own tobacco. The laboratory is yet to be equipped. Provision was also made for experiments in "controlled curing", two large chambers having been constructed in the building. A greenhouse will be necessary and may be constructed this coming year.

Field Day

On July 30, 1923, a field day was held at the Station, about five hundred attending. Throughout the day visitors were conducted through the fields and the experiments explained.

Results of Field Experiments Seasons of 1922 and 1923

The nature of the tobacco crop is such that final data are not obtained until the crop has been fermented. In the case of the 1922 crop, this was not completed until a short time before Dr. Chapman resigned, August 1st, 1923, which event greatly delayed assembling the results. In the meantime, the 1923 crop had been harvested and the data taken. It was therefore decided to combine the results for both years, and present the averages in a separate bulletin, which will appear as Number 5 of the Tobacco Station.

AGRICULTURAL COLLEGE AND

TOBACCO SUB-STATION, BULLETIN 4 MARCH, 1924

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

TOBACCO SUB-STATION

WINDSOR, CONN.

Recommendations

For the

Control of Wildfire

(Revised)

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

Recommendations for the Control of Wildfire.

Wildfire did not cause serious damage in Connecticut and Massachusetts in 1923, probably due to the weather conditions which were unfavorable for its spread. However, we do not believe growers are justified in neglecting any of the control measures practiced in the past. The possible injury from wildfire is well known, and as long as it is present in the region, every precaution should be taken by all growers.

SEED BED.

1. *Seed Selection.*—Select seed plants in wildfire-free fields. At least be sure that the individual seed plants are free from infection. Bagging the seed heads may be useful. Old seed is less likely to be contaminated.

2. *Seed Sterilization.*—If seed infection is suspected, seed should be sterilized with corrosive sublimate or silver nitrate. Formalin is very apt to cause injury and should not be used.

a. *Corrosive Sublimate.* Soak for 15 minutes in a 1 to 1000 solution in a cheesecloth bag. Wash *thoroughly* and spread out to dry. Use for dry sown seed *only.*

b. *Silver Nitrate.* For seed to be sown sprouted, use this treatment, 1 to 1000 for 15 minutes. Wash and dry. Silver Nitrate is probably the best treatment in all cases.

Note. *Corrosive Sublimate* and *Silver Nitrate* are both *poisons* and should be handled with great care.

3. *Location of Beds.* Do not use refuse from tobacco sheds or tobacco stems as fertilizer in the seed bed. If possible locate the seed beds on land where there was no wildfire the previous year, and where there has been no opportunity for contamination by drainage from tobacco shed or other refuse.

4. *Sterilize the Beds.* Sterilize the soil with steam at 100 lbs. pressure for 30 minutes, or with formalin 1-50 at the rate of one half gallon to the square foot. It is safer to sterilize the walks also. Spring sterilization is safer than fall sterilization.

5. *Sterilize the Sash.* Boards, sash, and cloth used in seed beds should be drenched with formalin, 1-50. New sash, plank, or cloth need not be sterilized.

6. *Spray or Dust the Plants.* Keep the plants covered with copper lime dust or a copper spray, such as *Bordeaux mixture,* at all times from the stage when they are as large as the finger nail until setting is completed.

7. *Watering.* Adopt a system of bed management which will keep the leaves wet for no longer periods than is necessary to produce good plants.

8. *Disease in Beds.* If the disease appears in isolated spots in the bed, these spots along with a broad margin of healthy plants should be killed by drenching with 1-10 formalin. The sash must be left off the bed for several hours after application of the formalin; otherwise the enclosed fumes will kill or injure seedlings for a considerable distance from the original place of application.

9. *Planting.* Pull plants for setting only from disease-free seed beds. Do not use plants which have stood over night after pulling. Water a long way ahead of pulling, so that the plant leaves will be as dry as possible. Remember that the wildfire germs can be carried on the hands, clothing, tools, sash, etc., and avoid such chances. Wildfire may be readily carried into a clean field by walking through it after having walked through a diseased field.

FIELD.

10. Do not top dress fields with stalks or refuse from badly diseased crops.

11. Do not work in a field where there is any wildfire while the plants are wet.

12. Make frequent inspections as soon as the plants begin to grow in the field, and remove all diseased plants.

13. When the infection is light, removal of the diseased leaves at intervals of three or four days will reduce the number of centers of spread, and may materially reduce the amount of wildfire damage to the crop.

14. Destroy the second growth of suckers after the tobacco is harvested. These often become badly diseased and furnish an unnecessary possible source of infection.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 28

March 20, 1924.

WINTER CONDITION OF APPLE AND PEACH BUDS

By G. P. CLINTON and E. M. STODDARD, Botanists.

The possibility of winter injury to fruit buds, particularly of peaches, was expressed to the Station authorities by certain fruit growers at a recent conference. It was thought that this injury might have resulted not so much from excessive cold, since the temperature has been very low this winter in very few places in the State, but as the after-effects of the unusually dry summer and fall. The Station has been looking into this matter, both through the examination of apple and peach buds in the general region of the Station by Mr. Stoddard and Dr. Garman, and also through the cooperation of various growers over the State, who have kindly made an examination of their orchards at its request. The results of these examinations are set forth in detail here.

APPLES

The observers are all agreed that there has been no special winter injury to apple fruit buds so far as they have been able to ascertain. It is more difficult, however, to get exact data at this time of year with the apples than with the peaches, as the buds are smaller. Some think that possibly the buds are smaller than usual, due to the dry summer. Where there was a heavy crop of apples last year, especially with certain varieties, as Baldwin, there is a light set this year which, however, appears all right as far as it goes. Three growers complained of partridges or pheasants eating off the buds of certain varieties near the woodlands.

PEACHES.

There is undoubtedly considerable injury to the peach buds. This is most pronounced in the northern half of the State, as might be expected, and is least apparent near the Sound. In some places elevation seems to have had an effect, as the trees on the higher hills or slopes are more injured than those lower down. The yellow peaches are, as usual, injured more than the white. Those most seriously injured seem to be the Late Crawford, Hale

and Elberta. Some growers, however, report very little injury even to these, so that if conditions are very favorable at pollinization time and later, there will be a small to fair crop in most orchards and a good crop in a few. With most of the other varieties the outlook at present is for a fair to a good crop. We estimate that there can be a 25% winter injury of peach fruit buds and still a good crop result. However, if in addition to this, later conditions are very unfavorable, this injury becomes more important.

As some growers may be interested in the results obtained on different varieties or in different parts of the State, we append the data obtained by varieties arranged alphabetically.

Arp. 5-15% dead, Experiment Station Farm, Mt. Carmel, Stoddard.

Belle. 60% dead, Washington Depot, Hallock; 37%, Storrs, Hollister; 30-40%, East Longmeadow, Bilton; 25% Greenwich, Drew; 25%, Deep River, Spicer; 20%, Seymour, Coleman; 5-20%, Wallingford (Barnes), Stoddard.

Carman. 65% dead, Washington Depot, Hallock; 30-40%, East Longmeadow, Bilton; 30%, Farmington (Root), Stoddard; 15%, Seymour, Coleman; 5-10%, Southington (Rogers), Stoddard; 8%, Storrs, Hollister.

Champion. 70% dead, Greenwich, Drew; 50%, Washington Depot, Hallock; 30-40%, East Longmeadow, Bilton; 34%, Storrs, Hollister; 5-20%, Wallingford (MacDonald), Stoddard; 10% Seymour, Coleman; 5-15%, Mt. Carmel, Station Farm, Stoddard; 5-15%, Milford (Platt), Stoddard.

Elberta. 98% dead, East Longmeadow, Bilton; 95%, Washington Depot, Hallock; 75%, Seymour, Coleman; 70% high elevation, 30% lower down, 20% low elevation elsewhere, Middlefield, Lyman; 62%, Storrs, Hollister; 50-75% Southington (Rogers), Stoddard; 50%, Greenwich, Drew; 30-50%, Farmington (Root), Stoddard; 35%, Cannondale, Warneke; 25%, Deep River, Spicer; 15%, Wallingford, Barnes; 5-20%, Wallingford (MacDonald), Stoddard; 5-15%, Mt. Carmel, Station Farm, Stoddard; 5-15%, Milford (Platt), Stoddard; 5%, Branford (Cook), Stoddard.

Fox. 30-40% dead, East Longmeadow, Bilton.

Greensboro. 30-40% dead, East Longmeadow, Bilton; 25% Deep River, Spicer; 17%, Storrs, Hollister.

Hale. 75% dead, Storrs, Hollister; 50-75%, Southington (Rogers), Stoddard; 56%, Seymour, Coleman; 45%, Greenwich, Drew; 5-15%, Mt. Carmel, Station Farm, Stoddard.

Hiley. 10% dead, Greenwich, Drew.

June Elberta. 31% dead, Storrs, Hollister.

Late Crawford. 75% dead, Greenwich, Drew; 60-75%, old trees, 35-50%, young trees, Southington, Rogers; 56%, Storrs, Hollister.

Lola. 5-15% dead, Mt. Carmel, Station Farm, Stoddard.

Mayflower. 5-15% dead, Mt. Carmel, Station Farm, Stoddard.

Mountain Rose. 71% dead, Storrs, Hollister.

Nectar. 54% dead, Storrs, Hollister; 30-40%, East Longmeadow, Bilton.

Rochester. 5-10% dead, Southington (Rogers), Stoddard.

Stump. 25% dead, Deep River, Spicer; 15%, Wallingford, Barnes.

Slappey. 54% dead, Storrs, Hollister.

Waddell. 27% dead, Storrs, Hollister; 25%, Deep River, Spicer.

Yellow St. John. 64% dead, Storrs, Hollister.

General Data. 50% dead, Norwich, Browning; 40-50% dead on old trees of white varieties, little injury on young trees of white varieties, Southington, Rogers; 50% dead on yellow varieties but only 25% on white, Farmington, Root; 10% dead on white varieties, Branford, Stoddard; a little injury to Crawford but none to Elberta, Meriden, Ives; Elberta hurt a little but Hiley and Belle of Georgia with heavy set, Hazardville, Billings.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 29

March 22, 1924.

DORMANT SPRAYS FOR ORCHARD PESTS.

W. E. BRITTON, PHILIP GARMAN, Entomologists,
G. P. CLINTON, Botanist.

San José Scale. May be present on the bark of twigs and branches under small circular gray shells about two millimeters in diameter. Each sucks the sap. Later in the season the scales appear on leaves and fruit. There are four generations each season. Spraying the dormant trees with miscible oil, 1 part in 15 parts water, with liquid lime-sulphur (1-9), or dry lime-sulphur as directed by the manufacturer, is recommended.

Tent Caterpillar and Fall Canker Worm. The eggs of the tent caterpillar are now present as dark-colored cylindrical masses on the small twigs, covered with a glue-like coating. Those of the fall canker worm are in compact circular, rectangular or irregular masses on the bark of the larger branches. There is some evidence to show that lime-sulphur will kill the young tent caterpillars if applied just before hatching.

Other Insects. Aphid eggs are oval black and shiny objects on the new growth or around the fruit spurs. Eggs of the false or light apple red bug and of leaf hoppers are imbedded in the bark. The bud moth lives through the winter in inconspicuous cases fastened to the twigs around the buds, and the Oriental peach moth, which is present in Fairfield and New Haven Counties, hibernates in similar manner, usually nearer the base of the trees. These last mentioned pests are difficult to destroy in this condition and probably the dormant sprays will not seriously affect them. Some of the aphid eggs will be killed by the dormant spray, lime-sulphur being more effective than miscible oils.

European Red Mite. Owing to the favorable period for development of the pest last summer, apple orchards should be scouted this year, if not already done, for winter eggs of the European red mite. Should these be found in numbers (present on branches one to two inches in diameter and numerous enough so that the

branches appear red in color) prepare to treat with miscible oi If you are not planning a complete spray program for the summe months, it will probably be best to use oil even if the eggs are fe in number. Scalecide or Sunoco spray oil, diluted 1 gallon in 1 gallons of water, are recommended. Use fresh material if possibl or make sure that the contents of each can or barrel are thoroughl mixed and that the material emulsifies completely when placed i the spray tank.

A casual examination of seven apple orchards in the centra part of the State showed that two were heavily infested, two wit a moderate infestation, and the remainder with few or no egg Towns in which the worst infestations were seen were Milfor and Farmington.

Fungi. These carry over on the twigs both through the Mycel ium and the spores. The latter often show as more or less con spicuous pustules. Some of the common fruit diseases that winte over in or on the twigs are the scab, brown rot and leaf curl c peaches, and the fire blight, sooty blotch, black rot, and possibl scab, of pears and apples. So far dormant spraying for fungou troubles has not been very effective except in the case of peac leaf curl. In this case the lime-sulphur treatment given for Sa José scale is effective.

Spray the trees lightly, but thoroughly, and avoid drenching Make your application as soon as the buds begin to swell notic ably or show green at the tips.

If you are not sure that your orchard is infested, communicat with us and if possible send suspected material for examination.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 30

March 26th, 1924.

INFORMATION ABOUT INSECTICIDES AND FUNGICIDES.

G. P. CLINTON and E. M. STODDARD, Botanists,
W. E. BRITTON and PHILIP GARMAN, Entomologists.

FUNGICIDES.

Bordeaux mixture. Recommended for use on potatoes, musk-melons, grapes, cucumbers and seedbed tobacco,—sometimes for pink and prepink spray on apples. Fresh home-made mixtures are most effective, though commercial preparations are often used successfully. Either stone or hydrated lime may be used. Spray should contain 4 lbs. lime and 4 lbs. copper sulphate in each 50 gals. water.

Lime-sulphur, dormant or winter strength. Recommended for use on apples (dormant or delayed dormant), peaches (late dormant), and pears (delayed dormant) for control of peach leaf curl and such insects as San José scale, pear psylla, blister mite and aphis. Strength 1 gal. lime-sulphur in 9 gals. water. Dry lime-sulphur may be substituted at the strength recommended by the manufacturer.

Lime-sulphur, summer strength. For use as a general fungicide on apples and as an insecticide for control of the European red mite. Usual strength applied, 1¼ gals. to 50 gals. water. Dry-lime-sulphur may be substituted with good results.

Dry mix, self-boiled and "atomic" sulphur. Successfully used on peaches. Strengths recommended: *dry mix*, 8 lbs. superfine sulphur, 4 lbs. hydrated lime, and one-half lb. calcium caseinate to each 50 gals. water; *self-boiled lime-sulphur*, 8 lbs. stone lime, 8 lbs. sulphur, to each 50 gals. water; *"atomic"* or *"colloidal" sulphur*, 5 lbs. to each 50 gals. water.

Dusts. Sulphur dusts are satisfactory for use in control of peach scab and brown rot. Pure dusting sulphur is recommended and should be as fine as possible to obtain.

INSECTICIDES

Miscible oils. Valuable for control of the European red mite when used as a late dormant spray as the buds swell; will also kill scale insects. Strength recommended 1 gal. in each 15 gals. of water. Scalecide or Sunoco spray oil are suitable. Do not use on peach trees.

Lead arsenate. Used for control of chewing insects such as canker worm, codling moth, apple and thorn skeletonizer, Colorado potato beetle and others. The dry form of the arsenate is preferable, but the paste may be used. In each 50 gals of water use 1½ lbs. of the dry powder or 3 lbs. of paste.

Calcium arsenate. Should not in general be used on fruit trees, because of danger of burning the leaves,—but may be used on potatoes for control of the Colorado potato beetle; 1 lb. in 50 gals. water is the proper dilution. Sometimes used in dust form on apple trees.

40 per cent. nicotine sulphate. Recommended for control of red bug, aphis or other sucking insects, at the rate of ⅜ to ½ pint to each 50 gallons of spray. Commercial preparations are known as Black Leaf 40, Halls Nicotine, and N. P. C. Nicotine Sulphate.

Dusts. Nicotine dusts are successful in control of sucking lice on vegetable crops and the arsenical dusts may be used on fruit trees. Sulphur-arsenate dust may be used on apple varieties that are not subject to serious scab infection.

SPREADERS.

Any product containing soluble casein and lime, 1 part of casein to 3 parts of lime, may be used to increase the adhesiveness of the above sprays. The most widely known product now on the market is sold under the trade name "Kayso".

CAUTION.

If necessary to combine such sprays as nicotine sulphate, lead arsenate and lime-sulphur, combine in the following order: 1. lead arsenate, 2. nicotine sulphate, 3. casein lime, 4. lime-sulphur.

Oil sprays should be thoroughly mixed before dilution, and should not be used unless a complete emulsion is formed. Do not apply in freezing weather.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 31

March 28, 1924.

WHY AND HOW TO SPRAY.

G. P. CLINTON and E. M. STODDARD, Botanists,
W. E. BRITTON and PHILIP GARMAN, Entomologists.

THE WHY.

To get a high percentage of perfect fruit is the aim of the intelligent fruit grower. To attain this, proper control measures for the various fungous and insect pests are very important, and succeed best when the following points are taken into consideration:

Know your troubles. One must determine as accurately as possible what pests will probably attack the fruit before planning the spray schedule. The Experiment Station will gladly assist in this determination. After determining your common troubles remember that arsenical poisons, as arsenate of lead, control chewing insects and must be applied before or soon after they start feeding; that contact poisons, as nicotine sulphate, control sucking insects and must be applied to the insects themselves; that fungicides prevent but do not cure injuries by fungi and so must be applied before infection takes place.

Know your varieties. Varieties vary in susceptibility to different injuries especially fungous, and it is important to know the troubles to which each variety is subject. As, for instance, scab is bad on McIntosh, and red mite is most serious on Baldwin. A Bulletin of Immediate Information will follow this, giving a list of the most injurious fungous diseases on the apple varieties commonly grown in the State.

The environment. Environmental conditions are often determining factors in the severity of injury. Dry or moist localities cause variation in fungous attacks. In the case of cedar rust, nearness to cedars is the important consideration. Many insects are worse on trees near to woodland or brush and rubbish along fences. The age of the trees, the method of cultivation and pruning, the location as to air drainage and extreme temperatures are also important factors. The latter, as regards winter injuries, is not subject to control by spraying.

THE HOW.

The material. Use the materials recommended for the particular pests to be controlled. Usually several materials are combined to control more than one pest in a single application. (See Bulletin of Immediate Information No. 30, Insecticides and Fungicides.)

The machinery. Use a spray outfit to fit the work at hand and do not expect a worn out machine to give the best results. Do not wait until the outfit is in the orchard to find out what is the matter with it—know beforehand and fix it. Many growers are turning from the spray gun to the rod and nozzles and we believe this is good sense unless experienced men are handling the gun. High pressure is the latest notion, but we contend that excessive pressure frequently wastes material and causes injury, and that 200 lbs. or less, with proper nozzles will do the work. Clean the spray tank frequently.

The method. Make your sprayings thoroughly and timely. This does not mean drenching the bottom and missing the top, but just enough to cover all over, inside and out. Do not wait until the aphids have curled the leaves so that the spray will not reach them.

The weather. For control of fungi try to plan the spraying ahead of a storm, especially the early sprays for scab. This prevents the spores from germinating on the tender young leaves. Most sprays will stick if they may dry an hour before it rains. Avoid spraying in high winds and do not dust in more than a gentle breeze—better no breeze at all. With the late summer sprays do not apply them during very hot periods, preferably doing the work in the morning or late afternoon, to avoid burning of the foliage.

Number of treatments. The number of treatments will depend on the pests to be controlled —usually five or six as a maximum and three as the minimum, for fungi. In most seasons we cannot control apple scab with less than five sprayings, but varieties that do not scab can be handled with three, the calyx and two later sprays, unless some other pest becomes serious, when an extension of the schedule is necessary. Insects, especially chewing insects, can be controlled with one or two sprayings even if applied after they appear, but fungi must be controlled by spraying before they get a start and the plants need to be protected with a spray coating during the entire season of their infection, which means more careful and frequent sprayings.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. Slate, Jr., *Director.*

Bulletin of Immediate Information, No. 32

April 10, 1924.

VARIETAL SUSCEPTIBILITY OF APPLES TO DISEASES AND INJURIES.

G. P. Clinton, Botanist.

Some varieties of apples suffer more from certain fungous diseases than do others in the same orchard. When experience shows this as a common trait with the variety, we say that it is very susceptible to the disease. Such, for example, is evidently the case of Fall Pippin and McIntosh with relation to Scab, and of the Wealthy to Rust. The same thing holds true with regard to certain of the injuries, or so-called *physiological* troubles, not due to either fungi or insects. For example, Bitter Pit (locally known as Baldwin Spot), is most serious on the Baldwin Apple, and Water Core on the King.

Some of these troubles, especially those not due to fungi, are not controlled by spraying, while Spray Leaf Burn and Fruit Russet are the direct outcome of spraying. Most of them, however, yield more or less completely to intelligent spraying. It behooves the grower, then, to know beforehand what are the troubles in his orchard, and what varieties are especially attacked. With this idea in view we compiled a list of apples more commonly grown in the state, and from our experience listed the diseases and injuries found most frequently on them. We then submitted this list to about forty apple growers for their opinion. The list that follows is based upon the combined data obtained.

Pick out from the list the varieties grown by you and note the diseases that more commonly occur; then spray with reference to them. Watch your apples the coming season and acquaint yourself definitely with the troubles of each variety. Insects are more general in their attacks, so we have not included them here, but it is just as important that you know what insects are common in your orchard, and include them in your fight for good fruit.

In this list we have printed in *italics* the non-parasitic injuries, and have listed these and the principal diseases under each variety in the order of their importance as near as we could. In general it can be stated that the four worst diseases of apples in this state

are: Scab, Brooks Fruit Speck, Rots (all kinds), and Sooty Blotch; and the three most serious injuries are: Winter Injury, Bitter Pit and Spray Russet.

Astrachan—Brown and Black Rots (bad), Scab.
Baldwin—*Bitter Pit* (bad), Brooks Fruit Speck (bad), *Spray Russet* (bad), Sooty Blotch, *Winter Injury,* Scab (little).
Ben Davis—Rust, Scab, *Spray Russet.*
Crabs—Scab (bad), Rust.
Delicious—Scab, Rust.
Duchess—Brooks Fruit Speck, Bitter Rot.
Early Harvest—Scab.
Fall Pippin—Scab (bad), Fire Blight.
Fallawater—Rust.
Fameuse—Scab (bad), Sooty Blotch.
Gravenstein—Rot, Scab, Brooks Fruit Speck.
Greening—Sooty Blotch (bad), Scab (bad), *Spray Russet* (bad), Blue Mold and Black Rots, Fire Blight.
Hubbardston—Rust, Brooks Fruit Speck, Scab, *Bitter Pit.*
Hurlbut—Black Rot, Brooks Fruit Speck, *Bitter Pit,* Fire Blight.
Jonathan—*Jonathan Spot* (bad), Rust, Brooks Fruit Speck.
King—*Water Core* (bad), Brooks Fruit Speck, *Barrenness.*
McIntosh—Scab (bad), Black Rot.
Northern Spy—Brooks Fruit Speck (bad), Scab, Sooty Blotch.
Opalescent—Scab, Brooks Fruit Speck, Fire Blight.
Peck's Pleasant—Rust.
Pound Sweet—*Water Core,* Brooks Fruit Speck, Scab.
Rome Beauty—Scab, Rust.
Russet—Rust.
Stark—Bitter Rot, Sooty Blotch, *Bitter Pit.*
Sutton—Rust, Scab.
Tolman Sweet—Sooty Blotch, *Bitter Pit,* Brooks Fruit Speck.
Wagener—Brooks Fruit Speck, Limb Canker.
Wealthy—Rust (bad), Brooks Fruit Speck.
Winter Banana—Rust.
Wolf River—Rust, Black Rot, Scab.
Yellow Transparent—Scab.
York Imperial—Rust.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 33

April 15, 1924.

THE PRE-PINK AND PINK SPRAYS FOR APPLES.

G. P. CLINTON, Botanist, and M. ZAPPE, Entomologist.

What are the Pre-pink and Pink Sprays? These are the two sprayings made fairly close together, if both are applied, between the dormant spray and the calyx spray. In other words they are semi-dormant to semi-summer sprays. They are applied usually between the last of April and the middle of May. The first is given when the fruit buds are just beginning to break through their enclosing leaves, and the second when the blossom buds are far enough advanced to show a decided pink color, but with none of the blossoms yet open. If the weather is favorable for rapid bud development they may be made within a week of each other; or the pre-pink may be made even earlier, near the delayed dormant as pictured by Darrow in his Spraying Bulletin (Extension No. 70) if there has been no dormant spray.

Why Used. Formerly these sprays, or at least the pre-pink, were not used to any great extent. To-day they are coming into more general use for a certain fungus on a variety susceptible to its attack, and for definite stages in the life history of a few insects. If this fungus or these insects do not trouble you in your orchard, then these sprays may be omitted.

When necessary for Fungi. Dormant or semi-dormant sprays are usually of little value for fungi in general. It may be that sooty-blotch is cleaned off the twigs to some extent, and that some spores of the black rot are killed, but for these alone it is very doubtful if these sprayings would be financially profitable.

With scab the benefits are much more evident. The reason for this is that on the young developing leaves the scab gets its first start. So far as we now know scab does not hold over to any great extent on the twigs, but depends for infection upon the mature stage that has developed on the old leaves on the ground. This stage begins to shoot its spores into the air about the time the young leaves are breaking through the buds, and the first or primary infection then takes place. If the scab gets a good start on these young leaves it is much more difficult to control later,

hence the necessity of keeping them fairly well protected from the time they begin to emerge from the buds until the calyx spray is put on. So far as apples are concerned the pre-pink and pink sprays need be used only on those varieties that are quite susceptible to scab. See Bulletin of Immediate Information No. 32.

When Necessary for Insects. The pre-pink and pink sprays are not as important for controlling insect pests as some of the later sprays. The European red mite and aphids may be controlled in both the pre-pink and pink sprays if they have not all been killed by the delayed dormant spray. Aphids if present at this time can usually be found on the new leaves and have not yet caused the leaves to curl around them. After the leaves are curled it is much harder to kill them with any spray.

There are a number of leaf-eating insects that begin to feed as soon as leaves appear. The most important ones are the larvae of the bud-moth, canker-worm, tent caterpillar and apple and thorn skeletonizer. Some of them spend the winter as larvae and are ready to begin to feed early. Others hatch from over-wintering eggs and the young begin to feed as soon as the foliage starts to grow. The pink rather than the pre-pink is the most important of these two applications for the control of leaf-eating insects.

What Sprays to Use. If you are spraying only for scab use the summer strength of a fungicide, namely, about 3 gallons of liquid lime-sulphur to 100 gallons of water, or the 8-8-100 Bordeaux mixture. There is not much danger of spray-burn or russet from the Bordeaux at this time. If insects are to be included in your control, nicotine sulphate can be added for the aphids and European red mite, and arsenate of lead for the leaf-eating insects. Nicotine sulphate is used at the rate of three-fourths of a pint, and lead arsenate (dry) 3 pounds to 100 gallons of the fungicide, or of water if the former is unnecessary.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.

W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 34

April 21, 1924.

SPRAY FOR THE IMPORTED CURRANT WORM.

B. H. WALDEN.

Nearly every spring the foliage of currants and gooseberries is injured by the imported currant worm, *Pteronidea ribesi* Scop. Often the owner does not notice the pest until many of the plants are partially stripped. This insect came from Europe nearly seventy years ago.

The adult is a four-winged fly, the female being about one-third of an inch long, with the head and thorax nearly black and the abdomen yellow. The male is somewhat smaller with a black abdomen.

The flies appear about the middle of April or soon after the foliage is well started, and lay rows of eggs along the veins on the under side of the leaves. The eggs are about one-twentieth of an inch long, nearly white in color, and hatch in about seven to ten days. The young worms are at first white in color, but soon change to green. After the first molt the worms are green, spotted with black. They become full grown in two to three weeks and are about three-fourths of an inch long when they descend into the ground and spin brown cocoons under leaves or rubbish. In late June or early July the adults of a second brood appear. The winter is passed in the cocoon stage.

TREATMENT.

The currant worm is a comparatively easy insect to control. As soon as the eggs begin to hatch, spray the plants thoroughly with lead arsenate, using $1\frac{1}{2}$ pounds of the powder to 50 gallons of water, or one ounce to a gallon for small quantities. Double the amount for paste. The application should be repeated in about one week to protect the leaves that have developed since the first treatment. Any of the dusts containing lead arsenate can be used in place of the spray if more convenient. These treatments

should protect the foliage from serious injury. If, however, it is necessary to give a treatment after the fruit is two-thirds grown, fresh *hellebore* should be used instead of lead arsenate, using two ounces to one gallon of water, or as a dust by mixing one pound of hellebore with five pounds of air-slaked or hydrated lime. While hellebore, if fresh, will readily kill the currant worms, lead arsenate is preferable for the early treatments as it will stick better to the foliage and remain effective for a longer time.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 35

April 25, 1924.

TREE WORKERS HOLDING CONNECTICUT CERTIFICATES.

TREE PROTECTION EXAMINING BOARD.

W. E. BRITTON, Entomologist, *President:* G. P. CLINTON, Botanist, *Vice-President:* W. O. FILLEY, Forester, *Secretary-Treasurer.*

The Station is frequently asked to suggest someone to prune, repair or spray trees. In doing so merely as an accommodation, the Station neither implies guarantee of satisfaction nor seeks to advertise the business of any person or firm. However, the list at the end of this bulletin includes those who have qualified under the state law and hold certificates issued by the Tree Protection Examining Board. This law is as follows:

AN ACT CONCERNING THE IMPROVEMENT, PROTECTION OR PRESERVATION OF FRUIT, SHADE OR ORNAMENTAL TREES.

Chapter 181. *Public Acts of* 1919. (In effect July 1, 1919.)

SECTION 1. No person, firm or corporation shall advertise, solicit or contract to improve the condition of fruit, shade, forest or ornamental trees, by pruning, trimming or filling cavities, or to protect such trees from damage by insects or disease, either by spraying or any other method, without having secured a certificate as specified in section two of this act; and any person, firm or corporation failing to comply with the terms of this act shall be fined not more than one hundred dollars; provided any person may improve or protect any tree on his own premises or on the property of his employer or on any property within the limits of the town of which he is a legal resident, without securing such a certificate.

SEC. 2. The botanist, entomologist and forester of the Connecticut Agricultural Experiment Station shall constitute a board which shall, upon application from any person, firm or corporation, examine the qualifications of the applicant to improve, protect or preserve fruit, shade, ornamental or forest trees, and if satisfied that the applicant is qualified, may issue a certificate so stating; which certificate shall be valid for one year from the date of its issue, unless sooner revoked as provided in section three of this act, and may be renewed by the board for succeeding years without further examination, upon payment of the fee hereinafter required, provided any person, firm or corporation receiving such certificate shall be responsible for the acts of all employees in the performance of such work.

SEC. 3. Said board shall prepare all necessary forms and prescribe all rules and regulations governing examinations, and any certificate issued under the provisions of this act may be revoked by it upon proof that improper methods have been used or for other sufficient cause.

SEC. 4. Each applicant for an examination shall pay a fee of five dollars in advance, and a fee of two dollars for each certificate or renewal issued; which fees may be expended by the board for any expense incurred by it in making examinations or issuing certificates, and an account of all receipts and expenditures under this act shall be rendered annually to the state comptroller.

Under this law no one may carry on such a business outside of his own town unless he holds a certificate.

Up to this time 100 original certificates have been issued. A few have been cancelled and several have not been renewed. There has been one prosecution of a man who solicited and performed work without a certificate, in violation of the law. Property owners are respectfully requested to notify this Board of anyone suspected of operating in violation of the law.

The following list gives the names and addresses of those persons and firms engaged in tree work who now hold certificates from this Board. Changes will occur as some fail to renew and examinations are held from time to time and new names are added. In general it is best for a property owner to employ some one in his locality, as it saves traveling expenses. Particularly if he knows one personally or by reputation and has confidence in his work, he should employ that man or firm. If he is not familiar with such work and is unacquainted with all on the list, he can readily make inquiries regarding those nearest his property and thus make a selection. Some of these men, in addition to their tree work, are also nurserymen and landscape architects. The list follows:

FIRMS AND INDIVIDUALS HOLDING CERTIFICATES.

Name	Address	Cert. No.	Certificate Expires
Armstrong Tree Service, Ltd....	Poughkeepsie, N. Y.		
Armstrong, Newton G........	" "	86	May 25, 1924
Parmelee, Leland E..........	" "	89	Jul. 23, 1924
Baldwin, Thos. J..............	P. O. Box 176, Guilford, Conn......	21	Jul. 15, 1924
Bartlett Tree Expert Co., F. A. (F. A. Bartlett).............	Stamford, Conn.....	10	Jul. 15, 1924
*Barton, Robert...............	P. O. Box 57, Hamden, Conn......	66	Dec. 18, 1924
Beaupain & Saunders (Henry F. Beaupain).........	So. Norwalk, Conn..	27	Aug. 12, 1924
Belletti, Peter J..............	R. F. D. No. 2, Naugatuck, Conn...	41	Nov. 6, 1924
*Bertolf Brothers (August C. Bertolf)..........	Sound Beach, Conn..	24	Jul. 29, 1924
Brown, Edgar M..............	211 Sisson Ave., Hartford, Conn......	52	Jun. 6, 1924
Calverley, Arthur.............	763 Campbell Ave., West Haven, Conn..	97	Mar. 31, 1925

* Is also a nurseryman.

Name	Address	Cert. No.	Certificate Expires
Cardarelli, Emilio J.	Cromwell, Conn.	57	Feb. 28, 1925
Clark, Harry F.	Middlebury, Conn.	72	Mar. 8, 1925
Clark, Wyllis S.	New Canaan, Conn.	20	Jul. 15, 1924
Clyne, G. A.	73 Canal St., Waterbury, Conn.	5	Jul. 1, 1924
Condon Co., Maurice L. (Maurice L. Condon)	Lake Mahopac, N. Y.	46	Feb. 2, 1925
Cromie, George A.	18 Compton St., New Haven, Conn.	88	May 25, 1924
Davey Tree Expert Company,	Kent, Ohio.		
Baldwin, H. E.	Gen'l Delivery, Norwich, Conn.	91	Jul. 23, 1924
Gammie, Peter	P. O. Box 423, Stamford, Conn.	60	May 26, 1924
Grove, D. Q.	Kent, Ohio	87	May 25, 1924
†Desmond, Thomas H.	Simsbury, Conn.	50	Apr. 4, 1925
DeWolfe, John C. G.	85 Medford St., Medford, Mass.	80	Aug. 7, 1924
Easton, Clifford H.	P. O. Box No. 1, Scarborough, N. Y.	53	Jun. 16, 1924
*Elm City Nursery Co.	New Haven, Conn.	7	Jul. 1, 1924
*Ernst, Otto F.	Norwich, Conn.	79	Jul. 14, 1924
Fertsch, Ross L.	P. O. Box 220, Newburgh, N. Y.	84	Apr. 4, 1925
Galligan, Clarence W.	15 Admiral St., Allingtown, Conn.	74	Jun. 28, 1924
Gibbs, R. M.	33 Fairfield St., Pittsfield, Mass.	83	Apr. 4, 1925
Gilbert, J. E.	376 George St., New Haven, Conn.	61	May 26, 1924
†Goodwin Associates, James L.,	750 Main St.,		
Goodwin, James L.	Hartford, Conn.	39	Nov. 26, 1924
Pettee, Edward E.	" "	38	Nov. 6, 1924
Graf, Albert H.	P. O. Box 87, Bardonia, N. Y.	67	Dec. 18, 1924
Grovit, Albert	986 Whalley Ave., New Haven, Conn.	85	Apr. 6, 1925
Gustafson, Harry A.	P. O. Box 81, Watertown, Conn.	96	Mar. 25, 1925
Hartford Forestry Company	65 Sherman St.,		
Hansling, Philip, Sr.	Hartford, Conn.	17	Jul. 15, 1924
Hansling, Philip, Jr.	" "	16	Jul. 15, 1924
*Herthal, G. F.	228 Bunnell St., Bridgeport, Conn.	25	Jul. 29, 1924
Herthal, Gus., Jr.	228 Bunnell St., Bridgeport, Conn.	36	Sept. 17, 1924
Hollister, S. P.	Conn. Agr. College, Storrs, Conn.	47	Mar. 21, 1925
*Hunt & Co., W. W. (W. A. Wright)	167 Blue Hills Ave., Hartford, Conn.	33	Sept. 17, 1924
Kellner, Arthur H.	7 Grove St., So. Norwalk, Conn.	26	Aug. 12, 1924
*Kellner, Herman H.	Danbury, Conn.	101	Apr. 1, 1925
*Kelley, James J.	New Canaan, Conn.	19	July 15, 1924
Landscape Foresters Ltd. (C. E. Mager)	52 Vanderbilt Ave., New York City	32	Sept. 17, 1924

* Is also a nurseryman.
† Is also a landscape architect.

Name	Address	Cert. No.	Certificate Expires
*†Mallett Co., G. A. (George A. Mallett)	95 Catherine St., Bridgeport, Conn	11	Jul. 15, 1924
Maynard, Eugene	61 Coit St., New London, Conn	94	Feb. 6, 1925
McLaughlin & Carberry,			
Carberry, Joseph V	Sharon, Conn	78	Jul. 9, 1924
McLaughlin, J. A	" "	77	Jul. 9, 1924
Meader Co., L. H. (Lewis H. Meader)	75 Westminster St., Providence, R. I	31	Sept. 17, 1924
*Millane Tree Expert Co. (Neal A. Millane)	Middletown, Conn	1	Jul. 1, 1924
Morris, Harry H	9 Winthrop Place, Danbury, Conn	40	Nov. 6, 1924
Munson-Whitaker Co. (Robert O'Shea)	1 Washington St., Boston, Mass	42	Nov. 25, 1924
Old Colony Forestry Co. (Thomas J. McGinnis)	415 Savin Ave., West Haven, Conn	4	Jul. 1, 1924
Pauley Tree Expert Co. (George A. Pauley)	New Canaan, Conn	22	Jul. 29, 1924
Perry, Lewis	Southington, Conn	95	Feb. 6, 1925
Plumb, C. K. & J. C. (C. K. Plumb)	New Canaan, Conn	100	Mar. 31, 1925
Pool, William H	47 Sheffield Ave., Roslindale, Mass	63	Oct. 10, 1924
Rice, Ralph S	Care of Y. M. C. A., New Haven, Conn	69	Dec. 18, 1924
Rich, Nehemiah L	101 Warren St., Stamford, Conn	3	Jul. 1, 1924
*Rockfall Nursery Co. (Philip Marotta)	Rockfall, Conn	71	Mar. 8, 1925
Rottenberg, Julius	Newington Gardens, Newington Jct., Conn.	93	Jan. 9, 1925
Royal Forestry Co. (Charles Vallett)	124 Division St., Waterbury, Conn	62	Aug. 5, 1924
*Schoonman, W. J	New London, Conn	6	Jul. 1, 1924
Shaw, Walter	494 Blake St., Westville, Conn	55	Jun. 16, 1924
*Sierman C. H	2291 Albany Ave., W. Hartford, Conn	8	Jul. 1, 1924
*Steck, Harold W	Newtown, Conn	92	Jan. 10, 1925
*van Heinigen, Jacob C	So. Wilton, Conn	48	Apr. 4, 1925
van Kleef, Marinus	Bridgewater, Conn	75	Jul. 4, 1924
*Van Wilgen Company	71 Main St.,		
Van Wilgen, A. C	Branford, Conn	99	Mar. 31, 1925
Van Wilgen, W	" "	98	Mar. 31, 1925
*Verkade, H	Cor. Crocker St. and Lower Boulevard, New London, Conn	18	Jul. 15, 1924
Wilcox, Reginald C	Essex, Conn	30	Sept. 17, 1924
Wright, John L	P. O. Box 593, Putnam, Conn	43	Nov. 25, 1924

* Is also a nurseryman.
† Is also a landscape architect.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.

W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 36

May 1, 1924.

THE CALYX AND LATER SUMMER SPRAYS FOR APPLES

E. M. STODDARD and M. P. ZAPPE.

The *pre-pink* and *pink* sprays have been outlined in Bulletin of Immediate Information No. 33, and in this bulletin the *calyx* and later summer sprays will be discussed.

For convenience of reference, we will designate the calyx spray as summer treatment No. 3 (pre-pink and pink being Nos. 1 and 2 respectively) and the later treatments will be numbered in succession. As the formula for all of these sprays is the same except such additions as will be noted we will give the formula used and recommended by this Station.

Dry Arsenate of Lead. . . . . . . 1½ lbs. to 50 gals. water.
Spreader. . . . . ½ lb. to 50 gals. water.
Liquid Lime-sulphur. . . . . 1½ gals. to 50 gals. water.
(Dry Lime-sulphur can also be used with equally good results if preferred, following the directions of the manufacturer for dilutions.)

SUMMER TREATMENT NO. 3.

The calyx treatment should be put on immediately after the petals fall while the calyx cup is still turned up and open. This treatment is the most important insect spray on the schedule and depends on its timeliness for its efficiency. The principal insect to be controlled is the *codling moth*, but other important ones are *canker worms, apple and thorn skeletonizer* and *tent caterpillar. European red mite* will be controlled by the Lime-sulphur in this spray and if *aphis* and *red bug* are present, nicotine sulphate can be added at the rate of three-fourths pint to 100 gallons. We do not include the nicotine in the formula as oftentimes it is unnecessary and it adds materially to the cost of the mixture.

This spray is necessary in the control of *apple scab* but is not very efficient unless the pre-pink and pink sprays have been given. *Black rot leaf spot* is also controlled by this spray.

Summer Treatment No. 4.

Use the same formula as No. 3 and apply two weeks later. For leaf eating insects and late scab infection.

Summer Treatment No. 5.

Same formula as before and put on first week in July. For apple and thorn skeletonizer, apple maggot, fruit speck and sooty blotch.

Summer Treatment No. 6.

Same as No. 5 and applied the last week in July. For second brood codling moth, apple maggot, fruit speck and sooty blotch.

Notes.

Nos. 5 and 6 should not be put on when it is excessively hot nor at extra high pressure, as foliage injury is likely to result.

Nicotine sulphate may be added to the last two treatments if leaf hoppers are prevalent.

Extra sprays immediately following the calyx for the control of curculio have not been recommended as their value is somewhat doubtful. In recent work at this Station, there are indications that these sprays may be of benefit, not so much from the poison as by the repellant action of any material that is on the fruit.

We do not feel safe in recommending dust for control of apple troubles, but if one wants to use it, the same schedule may be followed.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.

W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 37

May 3, 1924.

PEACH SPRAYING

E. M. STODDARD and M. P. ZAPPE.

Fungous and insect troubles are not as numerous on peaches as on apples and a schedule of one dormant spray of liquid Lime-sulphur 1 to 9 for scale and leaf curl, and three summer treatments of spray or dust will usually give good control of the important fruit and foliage troubles.

It has been our experience that dusting will give as good results as spraying for the summer treatments, but so far we cannot recommend dust as a dormant treatment.

SCHEDULE OF SUMMER TREATMENTS.

No. 1. When shucks have fallen.
No. 2. Three weeks after No. 1.
No. 3. Three to four weeks after No. 2.
Note. Brown rot is more difficult to control than scab. In very wet seasons a fourth treatment about three weeks before the fruit ripens is desirable.

Any one of the following materials may be used for the summer treatments:

ATOMIC SULPHUR.

5 lbs. to 50 gallons.

This is a ready mixed commercial material in paste form which mixes readily with water, and gives uniformly good results under Connecticut conditions.

DRY MIX SULPHUR-LIME.

8 lbs. sulphur.
4 lbs. hydrated lime.
½ lb. casein spreader.
50 gallons water.

The dry ingredients are mixed together and washed through the strainer while the tank is being filled with water. This mixture was originated at the New Jersey Station and has given good results on peaches in that state.

Self-boiled Lime-sulphur.

8 lbs. sulphur.
8 lbs. stone lime.
50 gallons water.

The sulphur is sifted into the slaking lime and allowed to cook by the heat of the lime for fifteen minutes, then diluted and strained into the spray tank.

Dusting Sulphur.

In our experiments we have used sulphur dust without lime or lead arsenate. This has given good results in the control of brown rot and scab, and no injury has resulted. Our experience with arsenical poisons on peaches does not warrant us in recommending their use, as injury often results, and our data show that curculio are not appreciably controlled.

Peach Borer.

The peach tree borer is doubtless present in every peach orchard in the state. It is a white grub found in the trunks of the trees at or near the soil level, its presence being indicated by masses of gum and wood particles. These grubs reach the adult stage between July and September and the female moths begin laying eggs soon after emerging. These eggs hatch in about ten days and the young borers begin entering the trees at once.

The use of *paradichlorobenzene* is supplanting the old method of "worming" in the control of this pest. The paradichlorobenzene treatment is as follows:

Clear all rubbish from around the base of the tree and put three fourths to one ounce of the material on the soil in a circular band about two inches from the trunk of the tree. *It should never touch the tree.* Cover the material with soil, free from rubbish, to a depth of four or five inches. This mounding of the soil is important because the chemical is effective only to the height of the soil on the tree. Make the application about September 15th. Do not use paradichlorobenzene on trees under three years of age. On trees from three to six years old the material should be removed after three weeks, but on older trees it may be left indefinitely.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.

W. L. Slate, Jr., *Director*.

Bulletin of Immediate Information, No. 38

May 15, 1924.

GRAPE SPRAYING.

G. P. Clinton and E. M. Stoddard.

In view of the fact that grapes are becoming an increasingly important crop in Connecticut a few suggestions for the control of fungous and insect pests seem desirable. The spraying of grapes has an especial interest because the first spraying to be done for the control of fungi was made for black rot on grapes in France. Also the experiments of Thaxter in Connecticut in 1889 for the same disease were among the earliest in this country.

Black Rot.

Black rot is the chief disease of grapes in Connecticut. It causes first a brown rot on the green fruit and finally the characteristic black shriveled berries, often destroying the entire crop in wet seasons if no control measures are used. It also affects the stems and leaves. On the stems it does very little damage, but on the leaves it produces more or less extended brown spots in which are the fruiting bodies that spread the disease during the summer. The mummied grapes and infected stems carry the disease over winter and furnish a source of infection the following season. On this account the vines should be thoroughly pruned each year and the rubbish burned. The mummied fruits should also be removed as much as possible each fall and destroyed. The year following severe attacks of black rot special attention should be given to spraying.

Bitter Rot.

Bitter rot is a fungous disease, somewhat similar to black rot in its effect on the fruit, and occasionally does damage. The spray schedule for black rot will take care of it.

Mildews.

Downy and *powdery mildew* are fungous diseases of lesser importance which attack the foliage and fruit of grapes. The downy mildew produces a whitish tufted growth on the under surface of the leaves and causes a brown rotting of the fruit. The powdery mildew occurs chiefly on the upper surface of the leaf as a cotton-like growth. Neither requires treatment other than that given for black rot.

Spray Schedule.

No. 1—When leaves are small (about the middle of May.)
No. 2—Just before blossoming.
No. 3—Soon after blossoms fall.
No. 4—Two or three weeks later (according to weather.)
No. 5—Two or three weeks after No. 4.

Note—Do all spraying *very* thoroughly.

Use Bordeaux mixture 4-4-50 for all the sprayings with the addition of lead arsenate in the earlier ones *only,* for leaf eating insects if abundant. If the rot has been bad the previous year a delayed dormant treatment may be necessary and if the season is wet more sprayings after No. 3 are desirable. *Do not spray after August 1st* as the spray will show on the ripe fruit. In the later sprays the addition of a casein spreader is advised as the Bordeaux adheres rather poorly to the fruit.

Spraying with self-boiled lime-sulphur has been used with some success as a repellant for *rose chafers.*

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.

W. L. Slate, Jr., *Director.*

Bulletin of Immediate Information, No. 39

May 17, 1924.

THE APPLE AND THORN SKELETONIZER.

W. E. Britton.

This European insect was discovered in this country in Westchester County, New York, in 1917. It appeared in Connecticut at Greenwich and Stamford late in 1920, has now spread all over southern New England, and is present in northern New Jersey and in the Hudson River Valley of New York State at least as far north as Albany.

There are three generations each year, and the insect passes the winter in the adult stage (as a moth). The first moths this season were observed flying in New Haven on April 10. Larvae of the first generation will feed upon the apple trees the last half of May and first part of June; those of the second generation during July, or from late June to early August; the third generation larvae from late August up to about the middle of October.

The eggs are mostly laid singly on the under surface of the leaves, often beside the mid-rib or a large vein, and the egg-laying period is extended over two or three weeks. The eggs hatch about a week after being laid and the tiny larvae eat away small patches from the under surface, then go to the upper surface of the leaf where they spin a light web across the leaf, fastened at the opposite edges. Under this web the larva feeds upon the leaf tissue, often devouring all except the lower epidermis and the veins; and becoming full grown in about three weeks.

A white cocoon is then made, usually in a fold or along the midrib of a leaf, about three-fourths of an inch long and pointed at both ends. In about two weeks the moth emerges.

Further information may be obtained about this insect by consulting Bulletin No. 246 of this Station.

Control Measures.

Commercial orchards are usually properly sprayed and are not injured by this pest. Unsprayed trees may be completely de-

foliated and seriously weakened. Fruit trees around the home are prized both for their shade and for their fruit and should by all means be given the attention which they deserve.

The usual spray schedule, providing for a number of applications of lead arsenate will control the apple and thorn skeletonizer. Even where trees are not injured by the first generation of larvae, the second or third may defoliate them. From one to one and one-half pounds of dry or powdered lead arsenate in fifty gallons of water, sprayed upon the leaves is effective. The sprays should be applied when the larvae are just beginning to feed rather than when they are ready to make their cocoons. The approximate dates of these applications are: May 15 (or calyx spray), July 1, and August 10.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 40

May 20, 1924.

SPRAYING SHADE TREES.

W. E. BRITTON.

Shade trees are sprayed during the summer months for the purpose of controlling various chewing and sucking insects which attack the foliage and occasionally to prevent injury from fungous diseases. By far the most common reason for spraying is to control certain chewing insects.

CHEWING INSECTS.

Elm Leaf Beetle: Over-wintering beetles eat holes in leaves during May and deposit on the under sides of the leaves clusters of yellow eggs which hatch about June 1, and the grubs feed on the under surface, skeletonizing the leaves, which in severe attacks turn brown and fall about July 15-20. Only elm trees are attacked. The remedy is to spray the under surface of the leaves thoroughly during the first week in June with lead arsenate, using 2-3 lbs. of the dry powder in 50 gallons of water. In all of the sprays it is advisable to add two pounds of calcium caseinate for a spreader.

Canker Worms: Eggs hatch with the unfolding leaves and the larvae feed upon the leaves of all kinds of deciduous trees. Spray with lead arsenate by the middle of May or as soon as there is enough leaf surface to catch and hold the poison.

Tent Caterpillar: Over-wintering eggs hatch with the unfolding leaves and caterpillars make nests or webs in the crotches of trunk and branches, and devour the foliage. Apple and wild cherry are the common food plants, but when exceptionally abundant as is the case this season, oak and other trees may be attacked. Spray about May 15 with lead arsenate.

White-Marked Tussock Moth: Curious and striking tufted caterpillars devour the leaves of various fruit and shade trees during June and August, there being two broods each year. These caterpillars have bodies striped lengthwise with brown and yellow and with red heads. There are four tufts of white or yellow hairs on the back, two pencils of black near the head and one on the tail. Spray with lead arsenate.

Other Tussock Moths: The hickory and tessellated tussock moths also feed upon shade trees the last half of summer but are seldom sufficiently abundant to need treatment.

Fall Web-Worm: White webs near the ends of the branches in late summer show the presence of this insect, which attacks all kinds of fruit, shade and

forest trees, often defoliating them. Applications of lead arsenate in August will prevent injury.

Walnut Caterpillar: Hickory, black walnut and butternut trees are attacked and often entirely defoliated by white-haired blackish caterpillars, which feed in clusters. Spray with lead arsenate in August.

Pine Sawflies: Several species of sawfly larvae feed upon the various pine trees which are now planted for shade and for ornament. Trees are occasionally defoliated, causing serious injury. Spray with lead arsenate as soon as larvae are noticed.

Other Caterpillars: Many other insects, such as gipsy moth, various leaf rollers, birch leaf skeletonizer, etc., feed upon the folinge of shade trees and may be controlled by a spray of lead arsenate.

SUCKING INSECTS.

Various species of aphids suck the sap from the leaves of nearly all kinds of shade trees. Conspicuous examples are the woolly beech aphid of the copper or purple leaf beech, the yellowish green aphids on birch trees and the green aphid on Norway maple. Aphids usually occur on the under sides of the leaves and give off a sweet sticky substance called "honey dew" which drips upon the lower leaves and upon the ground appearing like a coating of varnish. A black fungus or sooty mold grows in the honey dew, which looks as though covered with soot.

The proper treatment is to spray the under sides of the leaves with nicotine sulphate, one-half pint in 50 gallons of water. Either a pound of calcium caseinate or two pounds of dissolved laundry soap should be added as a spreader.

The woolly maple leaf scale can best be controlled by spraying the trunk and base of the larger branches of infested trees in March or April with liquid lime-sulphur (1 to 9) as for San José scale. The same treatment should be given tulip trees as soon as the leaves drop in autumn to kill the newly hatched tulip tree scales.

LEAF FUNGI.

These are about the only fungi that are controlled by spraying and fortunately comparatively few are injurious enough on our shade trees to warrant this attention. Among the most prominent and injurious of these are the Leaf Blotch of the European Horsechestnut, and the Anthracnoses of Maples, Oaks, Poplars, Ash and Sycamores. Less frequent and injurious are the Leaf Spots of the Elm and the English Hawthorne. Spraying for any of these troubles should begin before the first sign of spots appears on the leaves; for the anthracnoses this means as soon as the young leaves begin to break through the buds. The treatments should be repeated at least twice at intervals of two or three weeks according to the weather. Bordeaux Mixture of the home-made 4-4-50 strength is the best fungicide, though commercial forms can be used to less advantage, at the strength recommended. Stewart, of the Cornell Experiment Station, found that dusting with finely ground sulphur was effective in controlling the Leaf Blotch of the Horsechestnut. In yards it is desirable to rake together and burn in the fall the leaves of this tree or, better still, put them in the compost pile.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. Slate, Jr., *Director.*

Bulletin of Immediate Information, No. 41

May 20, 1924.

THE ORIENTAL PEACH MOTH.

Philip Garman.

The Oriental peach moth is due to appear shortly in peach orchards in southwestern Connecticut. A close watch should be kept for it in fresh, rapidly growing shoots, the attack usually beginning when the shoots are about an inch long. Such shoots are tunneled by the young larvae which pass to another twig after they have eaten a half inch to an inch of the core. The larvae themselves are most commonly found in freshly wilted twigs. When the tree stops growing and the twigs harden, the larvae enter the peaches to feed, the natural result of this habit being a heavier infestation in late ripening peaches than in early varieties.

The eggs are laid singly on the underside of the leaves, often some distance from the tips of the twigs, and resemble codling moth eggs, though somewhat smaller, being flat and closely applied to the surface. In fact, the whole life history is similar to that of the codling moth, except for twig feeding habits of the larvae, and the number of generations, which in Maryland and Virginia number four in all, with sometimes a partial fifth. In Connecticut there are possibly three generations only, but the dates when they will appear cannot be stated with certainty. The first generation will doubtless appear at the time of the shuck-fall spray, when the first twig injury should be noticed. This will probably be about June first.

Distribution.

The Oriental peach moth has been recognized as occurring in Fairfield, New Haven and Hartford Counties. In other States it has been found in quince and apple (fruit) but so far it has only been seen in peach twigs and fruit in Connecticut.

Control.

Two factors prevent satisfactory control. The first is the habit of the larvae of rejecting the first few mouthfuls when entering a new shoot, or a peach; the second is the very rapid growth of the

peach tree when the insects are multiplying most rapidly, preventing a complete coating of arsenical or other poison. The only points of attack remaining are the egg and pupal stages, the latter being passed in small silken cocoons hidden in crevices on the bark, under bark scales or on the ground. The over-wintering larvae may often be found on the trunks of the trees near the ground, similar to the codling moth. So far there is no treatment known which is effective in killing the hibernating larvae or the pupae.

About 70 per cent. of the eggs, however, may be killed with nicotine sprays, and, if timed correctly, have proven successful in controlling infestations in Virginia. The first of these sprays should apparently be given at the shuck-fall application and may be added to the regular sprays for curculio and fungous control. It is also the belief that many of the first brood larvae will pick up considerable poison at this time and be killed. The dilution of the nicotine used should be about 1 part in 800, or one-half pint in 50 gallons. Nicotine sprays for later broods are also necessary, but the exact time for this application has not been determined for Connecticut.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.

W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 42

June 10, 1924.

SPRAYING POTATOES.

G. P. CLINTON, Botanist.

Spraying potatoes against fungous diseases has made slow progress in this State. The reasons for this slow progress are three fold: the potato is not a main crop, on which farmers depend for their chief income; there are few very large growers who can be depended on to set the pace; and last, late blight, the chief reason for spraying, does not cause wide-spread loss every year. However, each year sees more Connecticut farmers growing potatoes on a commercial scale, and these men are, almost without exception, spraying thoroughly and with profit.

Long continued experiments in New York, New Jersey and Connecticut prove beyond doubt that thorough, consistent spraying pays, every year, especially on late potatoes. Aside from protection from late blight, spraying with a fungicide helps in a minor way to lessen loss from early blight and tip-burn, and, when combined with insecticides, gives adequate protection against the Colorado beetle and leaf hopper, and moderate control of the flea beetle and aphis.

In this state late blight rarely if ever appears before the middle of July, so that spraying would not need to start before that time were it not for the fact that this is a little late for the control of the insect pests and the early blight, and for the further fact that when started this late it is usually impossible to coat thoroughly the lower parts because of the heavy growth of the vines at this time. For these reasons we advocate the starting of the spraying when the plants are six to ten inches high.

For a small acreage, a barrel pump may be mounted in a wagon. A boom is easily attached or the spray may be applied with lines of hose. Commercial growers find it much more profitable to use traction or power sprayers specially designed for potatoes and similar crops. When the vines are small, one nozzle will cover a row but for later sprayings, three nozzles are essential. Several satisfactory traction sprayers are now on the market.

Low pressure is often a cause of poor spraying. The gauge should never drop below 150 lbs. for good results, and 200 lbs. is better still. Successful potato spraying depends not only on beginning early, but also on thoroughness. Keep the foliage coated. A single nozzle per row will not cover, and lines of hose, while effective, make the labor cost too great. The high pressure machine with three nozzles per row is the only satisfactory rig for large areas.

Spraying should be repeated every ten days to three weeks according to the weather conditions and rapidity of growth of the foliage. Keep the foliage coated at all times, and especially see that it is particularly well coated before a rain. *If one can spray and have the spray dry on just before a rain, this is particularly desirable.* Under these conditions it will take from five to seven sprayings with a traction sprayer to thoroughly protect a field of late potatoes during the season. Ridging the rows early in the season helps to make driving through the field easier and with less injury to the vines. It makes for better coating of the foliage, favors more rapid evaporation of moisture from the vines, and protects the tubers more thoroughly from infection by burying them deeper in the soil.

We recommend only home-made 5-5-50 Bordeaux mixture for potato spraying. To this can be added 3 lbs. of lead arsenate paste, or 1½ lbs. of the dry form, for the first two or three treatments as needed for the control of insects. Farmers are reluctant to make their own Bordeaux mixture despite the fact that it is cheaper and more efficient than the commercial forms. However, where the home-made mixture is impossible, use the commercial forms at the strength recommended. Some growers in other states have had good results with dusting, but our results so far here are much less satisfactory than with spraying.

Home-made Bordeaux can be made as follows:

5 lbs. Copper Sulphate (Blue Vitriol).
6 lbs. Fresh Lime.
50 gallons Water.

Note—Low magnesia lime leaves less sediment and does not wear out the discs so rapidly as high magnesia.

For small acreage. Dissolve the copper sulphate in hot water. Slake the lime and strain through coarse cheese-cloth. Dilute each separately to 25 gallons. Pour together slowly through a strainer into the spray barrel.

For large acreage. Made stock solutions of copper sulphate and lime as follows: Dissolve 50 lbs. of copper sulphate in 50 gallons of water, by suspending in a grain sack. One gallon of stock solution thus contains one pound of copper sulphate. Slake 60 lbs. of lime, strain into a barrel and make up to 50 gallons. The excess takes care of waste in slaking. Put two 50-gallon dilution barrels on a platform so that the sprayer can be backed under them. For a 100-gallon sprayer put 10 gallons of stock lime solution into the lime barrel and 10 gallons of stock copper sulphate solution into the copper sulphate barrel. Dilute each to 50 gallons. By using a molasses spigot for each barrel, the two streams may be run together through a trough into the sprayer. A large fine wire strainer should be set in the sprayer opening. Lead arsenate, Paris green, or nicotine solution may be added if needed. Hydrated lime is handy to use, but Bordeaux made with it is said by some not to adhere so well.

Some growers get good results with the following method: Start filling the sprayer with water, washing in at same time 10 gallons of the stock lime solution through the strainer. When half full, add the 10 gallons of stock copper sulphate solution with the remaining water, stirring meanwhile. When short handed this method saves time. Half of these amounts are used for a 50-gallon sprayer.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.

W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 43

June 16, 1924.

THE APPLE MAGGOT OR RAILROAD WORM.

W. E. BRITTON

The apple maggot or railroad worm, *Rhagoletis pomonella* Walsh, is a serious pest of apples in Connecticut. The maggot tunnels in the ripening fruit, causing it to decay. It usually attacks the less acid and early maturing varieties, often rendering the fruit worthless. In certain seasons it also infests the late maturing and acid varieties like Greening and Baldwin. Sweet and subacid varieties are commonly attacked and the fruit ruined by this insect.

This is a native American insect which formerly bred in the wild thorn and in blueberries and huckleberries. The adult is a two-winged fly, with dark cross bands on the front wings, which emerges early in July and feeds for two or three weeks on drops of moisture on the leaves and fruit before laying eggs. The female has a sharp ovipositor with which she punctures the skin of the fruit and lays an egg in the pulp, just beneath the skin. This egg is whitish and elongated and hatches in from two to six days, when the young maggot begins to tunnel through the pulp of the fruit. They make little headway until the fruit ripens and becomes soft, then they increase rapidly in size and the injured fruit decays, the pulp becoming a brownish spongy mass. Sometimes the tunnels extend close to the skin and show from the outside, but in other cases there is no external evidence that the fruit is infested, though on cutting open, it may be found worthless. When mature the maggot leaves the apple and goes about an inch into the soil and pupates. There is probably a partial second brood, and development may proceed in fruit in storage if the temperature is sufficiently high.

Control Measures.

Formerly it was recommended that all drops be gathered and destroyed and that late cultivation be practiced to kill the pupae in the soil. Now it is known that spraying the trees with arsenate of lead (1 to 2 lbs. of the dry powder in 50 gallons of water) during July will prevent serious injury from this pest, as the flies feed upon the poisoned moisture on the foliage and are killed before they lay eggs. One application should be made about July 4th or earlier for early varieties, and another about July 25th, or three weeks after the preceding application.

Some Connecticut orchardists are already spraying several times after the trees blossom. Thus the apple maggot spray given the first week of July will control the second brood of the apple and thorn skeletonizer, and the second treatment should control the second brood of codling moth.

In case later applications are made to control sooty blotch on winter varieties, lead arsenate may also be included as an additional protection against the apple maggot.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 44

July 15, 1924.

THE GIPSY MOTH QUARANTINE.

W. E. BRITTON, *State Entomologist.*

The Federal Horticultural Board has recently revised the Federal quarantine (effective July 1, 1924) on account of the gipsy moth, to include the Connecticut towns of Cornwall, North Haven, Branford, North Branford, Guilford, Madison, Clinton, Killingworth, Durham, Haddam, East Haddam, Lyme, Chester, Saybrook, Westbrook, Essex and Old Saybrook, not included in the Federal quarantine of 1923. As the State quarantine had not been revised since 1922 (see quarantine Order No. 4), it seemed advisable to make it correspond with the Federal quarantine. Consequently after due notice as provided in Section 2106 of the General Statutes, a hearing was held at Hartford on July 9, 1924, and the subject fully discussed. There was no opposition expressed and the following quarantine order was issued:

STATE OF CONNECTICUT

AGRICULTURAL EXPERIMENT STATION.

NEW HAVEN, CONN.

QUARANTINE ORDER NO. 6.

Concerning Gipsy Moths.

In order to protect uninfested parts of Connecticut from danger of infestation by the gipsy moth, under authority given in Section 2106 of the General Statutes, the following regulations are hereby established.

1. The following towns are hereby placed under quarantine becaus of the gipsy moth:—

HARTFORD COUNTY:

Avon	Farmington	Plainville
Berlin	Glastonbury	Rocky Hill
Bloomfield	Granby	Simsbury
Bristol	*Hartford*	*Southington*
Burlington	Hartland	South Windsor
Canton	Manchester	Suffield
East Granby	Marlborough	West Hartford
East Hartford	New Britain	Wethersfield
East Windsor	Newington	Windsor
Enfield		Windsor Locks

LITCHFIELD COUNTY:

Barkhamsted	Harwinton	Plymouth
Canaan	Litchfield	Salisbury
Colebrook	New Hartford	Thomaston
Cornwall	Norfolk	Torrington
Goshen	North Canaan	Winchester

MIDDLESEX COUNTY:

Chester	East Hampton	Middletown
Clinton	Essex	Old Saybrook
Cromwell	Haddam	Portland
Durham	*Killingworth*	*Saybrook*
East Haddam	Middlefield	Westbrook

NEW HAVEN COUNTY:

Branford	Madison	Wallingford
Cheshire	Meriden	Waterbury
Guilford	North Branford	Wolcott
	North Haven	

NEW LONDON COUNTY:

Bozrah	Ledyard	Old Lyme
Colchester	Lisbon	Preston
East Lyme	Lyme	Salem
Franklin	Montville	Sprague
Griswold	New London	Stonington
Groton	North Stonington	Voluntown
Lebanon	Norwich	Waterford

TOLLAND COUNTY:

Andover	Ellington	Tolland
Bolton	Hebron	Union
Columbia	Mansfield	Vernon
Coventry	Somers	Willington
	Stafford	

WINDHAM COUNTY:

Ashford	Hampton	Scotland
Brooklyn	Killingly	Sterling
Canterbury	Plainfield	Thompson
Chaplin	Pomfret	Windham
Eastford	Putnam	Woodstock

These same towns have already been quarantined by the Federal Horticultural Board of the United States Department of Agriculture, and it shall be unlawful to remove from this quarantined area any woody nursery stock, lumber, cordwood, telegraph or telephone poles, railroad ties, or other forest plant products, unless the products shall have been inspected and certified by an authorized State or Federal inspector.

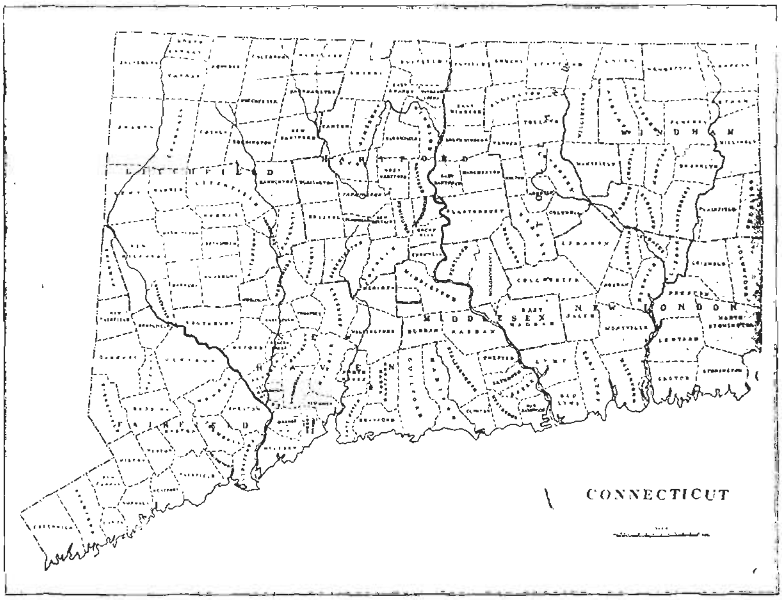
2. *In view of possible future changes in the lines between the infested* and non-infested areas of the State, the areas quarantined by the State shall conform to those quarantined by the United States Department of Agriculture: furthermore the regulations established by the Federal Horticultural Board of the United States Department of Agriculture for inter-state shipments, are hereby adopted for the inspection and certification of similar shipments from the quarantined area to points *outside of this area within the State of Connecticut.*

3. This order shall take effect from its date.

Dated July 20, 1924.

W. L. Slate, Jr.
Director, Connecticut Agricultural Experiment Station.

Approved:
Charles A. Templeton,
Governor.



The quarantined area is shown on the accompanying map, and includes the following towns not covered in quarantine order No. 4: Cornwall and Litchfield in Litchfield County; Cheshire, Wallingford, Meriden, North Haven, Branford, North Branford,

Guilford and Madison in New Haven County; Middlefield, Durham, Haddam, East Haddam, Killingworth, Clinton, Westbrook, Chester, Saybrook, Essex and Old Saybrook in Middlesex County; Lyme and Old Lyme in New London County.

All woody field grown nursery stock and forest products to be shipped from the quarantined area into the free area must be inspected by a State or Federal inspector and certified. All frequent shippers should procure a Federal map showing the quarantined area, the location and address of each Federal inspector and the area covered by him. These maps may be obtained from Mr. D. M. Rogers, 408 Atlantic Avenue, Boston, Mass.

An arrangement has been made by which inspections can be made by both State and Federal inspectors. Applications for inspection should be made to the nearest Federal Inspector or to:

D. M. Rogers, 408 Atlantic Ave., Boston, Mass., in charge of Federal inspection service; or

W. E. Britton, State Entomologist, Agricultural Experiment Station, New Haven, Conn., in charge of State inspection service.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.
W. L. SLATE, JR., *Director*.

Bulletin of Immediate Information, No. 45

July 19, 1924.

SUN SCORCH, ANTHRACNOSE, ETC., OF SHADE TREES.

G. P. CLINTON

SUN SCORCH AND WHIPPING WIND INJURIES.

Injury from Sun Scorch varies greatly in different seasons, but usually comes on suddenly and generally in the spring rather than later in the season. There are various conditions that favor this trouble and these are not always easily made out, so that in a row of street trees one sometimes finds trees badly scorched, and others in varying degrees up to little or no scorch. Injury to the roots or wood through recent transplanting, a previous dry season, winter injury, or insects and fungi are, no doubt, some of these obscure secondary factors. The chief causes, however, are dry seasons with hot days, and, where the trouble comes on suddenly, bright sunshine quickly following rainy weather. In the latter case the stomates of the leaves are likely to be open and transpiration of moisture from the tissues takes place faster than it is supplied by the roots, so that scorch at the edge or within the leaves results. A number of our shade and fruit trees such as the elm, beech, oak, ash, apple and peach are subject more or less to this trouble, but the chief sufferers are the maples, especially the sugar maples. Some have thought that the leaves of trees so injured were likely to continue to scorch and the trouble to spread to other trees, but as it is not a parasitic disease, it is not an infectious trouble.

Wind Injury may occur at any time of the year when the wind is strong enough to whip the leaves off the limbs, but the most serious injury is that which comes during violent wind and rain storms in the spring of the year when the leaves are quite tender, the lashing injuring or killing the tissue. This is often an accompanying feature of sun scorch at such a time, so that it need not be especially distinguished.

Where trees are injured by anthracnose fungi, late frosts when the leaves are young, gas leaks from street mains, or smoke from brick kilns, it is not always easy to distinguish these leaf injuries from the sun scorch trouble, especially on maples, since the leaves die in very much the same manner from the edges inward; evidence for any of these other causes must be looked for.

Maple. The maple trees in many places, especially in New Haven County, were injured this spring by sun scorch. Some

drop of leaves took place, but most of the injured leaves hung on and will show the red dead areas at their edges during the remainder of the season. In some cases the injury to the rootlets from the severe drought of last year no doubt favored this scorch. However the chief factor seemed to be their exposure on hills, etc., to the full force of a whipping wind and rain storm about May 24th, that was followed the next day by bright sunshine. This occurred before the leaves were fully grown.

Other Trees. We have seen no serious injury to other trees from scorch this year unless the trouble on beech is partly due to that rather than the anthracnose. Apple and pear trees, however, in some places showed minor injury from whipping winds when the leaves were young, turning them black at the edges.

ANTHRACNOSES.

These are fungous troubles that usually cause injury to the leaves or young twigs in the spring. While different trees may have a distinct fungus, the injuries resulting are much the same, as are the preventive treatments. In general the trees should be sprayed with Bordeaux mixture as soon as the leaves begin to develop, and have two or more subsequent treatments at intervals of about two weeks.

Sycamore. The anthracnose (*Glœosporium nerviseqnum*) of this tree was unusually abundant this year, due to the cold wet spring that held back the rapid growth of the leaves, so that abundant bud infection often killed the leaves before they had made much growth. As a result everywhere in the state the native sycamores showed an unusually scanty foliage. After killing the small leaves and buds, the fungus works down into the young twigs where it fruits and becomes a serious source for infection another year if the weather conditions prove favorable. These trees therefore should receive also a dormant spray just before the buds open. The European sycamore is not so susceptible to the disease, and young American sycamores show less than the older trees because twig infection has not become so common. Badly infected trees usually put out some additional leaves which escape serious infection.

Oak. White oaks also were more or less injured by an anthracnose fungus (*Gloeosporium cañadense*) this year. This is very similar to the sycamore anthracnose, but causes injury more on the mature or nearly mature leaves. However, we found it in some cases killing the very young leaves in the buds and fruiting on the stems.

Beech. For the first time we found an anthracnose fungus *Gloeosporium Fagi* var. *Americana*) on the beeches, especially on the Purple Beech, but not causing serious injury in most cases.

Maple and Ash. These trees also have anthracnose fungi that cause more or less injury to the leaves, though this year we had few complaints.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.

W. L. SLATE, JR., *Director.*

Bulletin of Immediate Information, No. 46

July 26, 1924.

PREMATURING OF VEGETABLES, ROTS OF LETTUCE AND SIMILAR TROUBLES.

G. P. CLINTON AND FLORENCE A. McCORMICK.

The spring and summer of 1924 have so far had somewhat unusual weather conditions. The spring was cold and wet, so that many ornamental plants, fruits and vegetables were very backward in their development. The blossoming period of apples and peaches was quite extended with a good bloom but only a fair set. Peonies were very late in blooming and of short duration. Some growers lost much of their vegetable seed because the conditions favored rot or dampening off. June and July came on warm and dry but with fairly cool nights. As a result of these conditions certain peculiar troubles, especially with vegetables, have developed. One of these is the prematuring, or going to seed, of plants that would not normally do so. The following are the crops of which we have heard complaint.

PREMATURING.

Cabbage. One grower had considerable trouble with cabbage that instead of heading out normally formed small heads and then started to blossom. He had to pull up those heads and feed them to the hogs. While the season, wet early and then dry, was favorable to this development, the fact that the plants were somewhat overgrown and had been held back before set out helped to favor this abnormal development.

Beets. It is expected that seedling beets if re-set may in some degree go to seed instead of continuing to form normal bottoms. The season favored prematuring to an unusual degree since not only re-set beets but also the undisturbed seedlings in some cases showed such a tendency.

Onions. There has been considerable complaint that onions grown from sets formed seed stalks to an unusual degree. Ebenezer or Japanese (considered by some as identical and by others as distinct strains), seem to be the most generally raised by vegetable growers. There apparently has been considerable difference in the production of seed stalks by these onions this year. As a result some growers regard the Ebenezer variety as no longer unmixed, others that it has degenerated and that the Japanese strain is superior, others that the source of the seed is the chief factor, while others that the time of topping and the character of the season have had the most influence. Such onions, if seed stalks are formed commonly, are very inferior since the stalk continues into the bulb as a hard center. Topping when very young is said ordinarily to overcome this trouble. Some growers had onions from two different sources planted on the same land at the same time that showed a marked difference in the formation of seed stalks.

Lettuce. A good summer lettuce seems to be needed in this state, as most of the varieties grown do not do so well in the warm summer weather. One of the difficulties complained of this year was the heads going to seed before they could be marketed. Big Boston gave more trouble in this respect than Salamander.

ROTS AND OTHER LETTUCE TROUBLES.

Basal Rot. There was general complaint of rots of head lettuce grown out of doors this year. The wet spring weather seemed to favor the maximum development of certain soil fungi and bacteria, and while the dry weather of June and July checked the rots, the cool nights still allowed sufficient moisture to collect in the soil under the plants and on the edge of the leaves to continue them less seriously up to the middle of July.

A study of infected plants from a number of growers showed two types of rots. The basal rot starts from certain soil fungi, *Rhizoctonia Solani* or rarely *Pythium deBaryanum,* that gain entrance through the leaves in contact with the wet earth. Ordinarily these do little harm as the infected basal leaves can be stripped off before any general invasion of the head occurs. But the present early wet season favored further infection of the leaves within the head, forming a general red heart rot. The Rhizoctonia mycelium in certain cases could be seen in dense masses entirely destroying the softer tissues. Neither of these fungi form aerial spores so that infection is through contact with the soil only. Both Salamander and Big Boston suffered from this type of rot.

Leaf Edge Rot. The second type of rot seemed to start from the edge of the leaves, probably favored by the moisture that accumulated there during rain or dewy nights, and worked down-

ward more or less irregularly into the head. Such heads often were entirely sound on the outside but when marketed complaint was usually made of interior rot. When broken open irregular larger or smaller areas of reddish brown rotted tissue would be seen. Under favorable moisture conditions these became enlarged into a more general head rot. Even when not conspicuous these rotten areas within the head rendered it of little commercial value, especially in an overstocked market. This type of rot was the more unusual and serious of the two. One grower lost 70% of 100,000 heads of Big Boston from this trouble. In this case our investigations seem to indicate that bacteria were the primary cause of the trouble as they were present in great quantities in the infected tissues where no fungi were seen. Eventually in both this and the basal rot other fungi, bacteria and nematodes occurred in the badly rotted tissues. The liberal use of manure on the land or green cover crops plowed under and not fully rotted would favor this type of bacterial rot. The spread from plant to plant may have been due to insect carriers.

Leaf Burn. Certain heads were seen that showed the exposed edges of the leaves seared inward for a short distance as if sun scorched. Within the tissue sometimes occurred a miscellaneous growth of saprophytic fungi. Whether or not this is a distinct type of injury or merely the arrested condition of the Leaf Edge Rot was not determined.

White Heart. This seems to be entirely a physiological trouble due to the type of lettuce or to the seasonal conditions. Big Boston is subject to it, and develops it most in the warmer season of the year. The heads are formed but instead of being compact, are rolled loosely with the central leaves irregular, whiter and harder. The outer leaves often droop and the lettuce besides being inferior in quality does not stand up well. There was some complaint of this trouble also.

Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.

W. L. SLATE, JR., Director.

Bulletin of Immediate Information, No. 47

July 26, 1924.

PREMATURING AND OTHER POTATO TROUBLES.

G. P. CLINTON.

PREMATURING AND WILT.

Potatoes and lawns are very good indicators of lack of moisture in the soil, as they show evidence of injury usually before other plants. With a wet, cold, backward spring one would not expect drought to become a serious factor this early in the year were it not a fact that June and July, so far, have been quite deficient in rainfall. As a result most crops are beginning to show the effects of insufficient moisture, and early potatoes are the first to suffer severe injury. The complaint, so far, this year is largely limited to Irish Cobblers.

The potato needs considerable moisture in the soil, especially when it reaches full foliage growth, as the leaves at the tips and margins are not well fitted to retain moisture during very bright warm weather. If water is not supplied to the roots as fast as it is lost by the leaves, either tip burn of the foliage or prematuring of the vines results. This year has been very favorable for the latter trouble, and has caused many to suspect that some unusual disease has been injuring the vines.

The vines when in their prime begin to turn yellow and die down. This dying may be very irregular over the field. It is somewhat similar to natural death, except it occurs too early, and before the tubers have reached their full growth. Sometimes there is a dropping over and partial wilting of the vines before they have lost their green color. This latter character was not very prominent this year, and may be taken as an indication of unbalanced fertilization. During the war, when it was impossible to obtain a sufficient amount of potash salts to make a balanced fertilizer, mixtures were often used that contained no potash, and, especially in 1918, a very dry season caused much trouble similar to the present, except that the wilting was a more pronounced feature. There was also some loss last year from prematuring because of the dry season.

What confuses growers as to the cause of the trouble is that early varieties like the Irish Cobbler go down where Green Mountain or other late varieties, sometimes in the same field, will look all right. This is

simply because the latter have not yet reached the state of maturity that favors prematuring from drought. Prematuring occurs in that stage of the plant when foliage growth has been completed and the plant is bending all its energy in the formation of tubers. This means that a lot of water is used, and when this is deficient in the soil during bright warm weather, the potatoes yellow and die prematurely. Let the drought continue and the late varieties reach the same stage of growth, they will go down in a similar manner. This was what actually happened in 1918.

Some fields premature sooner than others of the same variety, depending on such factors as earliness of planting, amount of humus in the soil, type of soil, and such other factors that lessen moisture in the soil. A gravelly knoll in a field may have the vines on it dead before the rest of the field shows much trouble. Vines at the edge of a field shaded by trees may still be green when those elsewhere are gone. The shading has held back their development.

Most Irish Cobbler fields we have seen are now almost too far gone to be benefitted to any great extent by rain. However where fields are not over half dead there will still be a considerable addition to the tubers before they finally die, especially if the dying takes place slowly. We have seen no serious injury yet to the Green Mountain potatoes. If abundant rain comes before long the late potatoes will pull through. If it comes a little late, they will show the injury partly through a decreased crop and partly through irregular knobs on the large tubers. If the drought continues long enough, they will suffer the same as the early ones have.

OTHER TROUBLES.

Up to the time of the drought potatoes had looked fairly well. In some cases, there had been a little rot of the seed before coming up. Black Leg and Rhizoctonia canker, minor troubles, possibly are somewhat more prevalent than usual. There has also been a little complaint of Scab. Early Blight so far has been inconspicuous, and there is no evidence yet of the Late Blight, as June and July have been too dry for these troubles. Tip Burn has not been conspicuous because we have had few very hot days. Lice have been fairly common in some of the premature fields, but their presence was not the cause of the prematuring though possibly aiding it somewhat. There is some complaint of irregular stands and stunted plants due to Mosaic and related diseases. With better inspection in the seed producing states we may expect this to decrease. Certified seed is the only remedy for these troubles.

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